ABSTRACTS OF NORTH AMERICAN GEOLOGY

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INTRODUCTION

Abstracts of North American Geology contains abstracts of technical papers and books and also citations of maps on the geology of North America including Greenland, the West Indies, as well as the State of Hawaii, Guam, and other island possessions of the United States. Articles of a general nature by North American authors are cited even though published in foreign journals, but those by foreign authors are included only if they appear in North American journals. Abstracts are prepared only of material that is believed to be generally available. Ordinarily abstracts are not published of material with limited circulations (such as dissertations, open-file reports, or memorandums) or of other papers presented orally at meetings.

The Abstracts will be an additional reference tool but will not replace the Bibliography of North American Geology, which has been published by the Geological Survey since 1887. Twelve monthly issues of Abstracts of North American Geology will be published each year. The Bibliography will include citations and subject index for a calendar year.

Abstracts of North American Geology and the Bibliography are being prepared by use of computer techniques. Each abstract along with its indexing is placed on magnetic tape and entered into a permanent data bank. The material prepared each month will be published in the form of the present issue. The abstracts are arranged alphabetically according to senior author. A subject index follows the abstracts and is designed for rapid reference to any subject desired. Bibliographies can subsequently be retrieved according to the terms used in the index.

The abstracts in this issue were prepared by John P. Albers, Fred Barker, Arthur P. Butler, Georgianna D. Conant, Margaret Cooper, David L. Durham, Ernest E. Glick, Richard E. Grant, Wanda L. Grimes, Andrew Griscom, John J. Hemley, Virginia M. Jussen, Benjamin F. Leonard, Sergius H. Mamay, Mildred C. Mead, James F. Mello, Alfred T. Miesch, Donal R. Mullineaux, Virginia S. Neuschel, Albert E. Roberts, Eugene H. Roseboom, Edward T. Ruppel, Roland W. Tabor, Dorothy B. Vitaliano, Holly C. Wagner, Walter S. White, Ray E. Wilcox, and E. W. Wolfe.

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Abbott, Agatin T. *See* Sunn, Franklin Y. K. 0577

0847 **Adams, William Mansfield; Furumoto, Augustine S.** A seismic refraction study of the Koolau volcanic plug: Pacific Sci., v. 19, no. 3, p. 296–305, illus., tables, 1965.

Seismic data from the GASHOUSE line support gravity and magnetic data showing a plutonic body under the center of the Koolau caldera near Kailua, Oahu. The plug has a velocity greater than 7 kmps and adjoining material at the top and southeast has a velocity of about 4.6 kmps. Top of the plug is 1,600 m deep, the width is 3.4 to 6 km, and reflections from a horizon over 3 km deep may show an underlying magma chamber. Drilling the plug would have considerable geologic and geophysical value and an appropriate site would be at the southwest corner of Kaelepulu Pond, which is close to the center of the plug as now defined. Seismic reflection work directly above the dome is recommended to test the present estimated depth based on seismic refraction results.—M.C.

0660 **Agashe, Shripad Narayanrao.** The extra-xylary tissues in certain Calamites from the American Carboniferous [abs.]: Dissert. Abs., v. 26, no. 1, p. 43, 1965.

0686 **Albee, A. L.; Bingham, E.; Chodos, A. A.; Maynes, A. D.** Phase equilibria in three assemblages of kyanite-zone pelitic schists, Lincoln Mountain quadrangle, central Vermont: Jour. Petrology, v. 6, no. 2, p. 246–301, illus., tables, 1965.

Petrologic and geologic arguments suggest that a close approach to chemical equilibrium at a single temperature and pressure might be found in rocks near Mt. Grant. Major mineral assemblages are: kyanite–chloritoid–chlorite–quartz–muscovite–paragonite–rutile; garnet–chloritoid–chlorite–muscovite–paragonite–ilmenite; and garnet–chlorite–biotite–quartz–muscovite–albite–ilmenite. Minerals were separated from a primary sample for each assemblage and subjected to gravimetric and spectrographic analysis. Additional spectrographic and partial gravimetric analyses were performed on chlorite, garnet, and chloritoid or biotite from 9 other samples. Distribution coefficients of each mineral pair were similar in nearly every sample for a given assemblage. Difference in two garnet–chlorite pairs is ascribed to variations in Al-content of chlorite.—M.C.

0948 **Allison, Edwin C.** Post-Miocene faunas of northwestern Baja California and adjacent Alta California [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 49, no. 7, p. 1078, 1965.

0659 **Alonso Espinosa, Héctor; Mooser, Federico.** El pozo M-3 del campo geotérmico del Cerro Prieto, B. C., Mexico: Asoc. Mexicana Geólogos Petroleros Bol., v. 16, nos. 7–8, p. 163–177, illus., table, 1964.

The prolific fumarolic and solfataric activity in the Laguna Volcano, which occupies an area of 10 sq km south of Cerro Prieto, Baja California, led to development of a geothermal field. In April 1964 the M-3 well was drilled, which produces steam and water from a first zone at depth of 600–900 m under 18 atm pressure and at a temperature of 210°C , reaching a yield of 200 tons an hour; a second zone is between 2,300 and 2,632 m, at which depth Quaternary fluvial sands and

lacustrine muds lie on granitic rock of the Cretaceous basement. The M-3 well is located on a block (horst), adjacent to an extraordinary vertical sinking east of the San Jacinto fault. The thermal activity seems to originate from a magma of intermediate composition, lying at great depth.—V.M.J.

0578 **Altschaeffl, A. G.; Christensen, Bent A.** Erosion and deposition of cohesive soils—Discussions [of paper 4204 by E. Partheniades, 1965]: Am. Soc. Civil Engineers Proc., v. 91, paper 4464, Jour. Hydraulics Div., no. HY 5, pt. 1, p. 301–308, illus., table, 1965.

Altschaeffl points out that in Partheniades' conclusion that resistance of soils to erosion by water appeared to be independent of the macroscopic shear strength, his tests were conducted with water only at ocean salinity, so that the influence of water quality could not be determined, suggesting that erosion of clay can be severe regardless of state of soil compaction, if the proper fluid environment is present. Christensen is especially interested in the author's analytical treatment of the problem that is based on the theory of statistics, but would correct some equations to clarify conflicting observations of velocity and hydrodynamic forces.—G.D.C.

Amos, D. F. *See* Mathews, H. L. 0724

0496 **Anda, L. F. de; Paredes, E.** La falla de San Jacinto y su influencia sobre la actividad geotérmica en el Valle de Mexicali, B. C., México: Asoc. Mexicana Geólogos Petroleros Bol., v. 16, nos. 7–8, p. 179–181, illus., 1964.

Areal geology of the Valle de Mexicali, Baja California, is outlined; geomorphologically the valley forms a part of the Colorado River delta; structurally its main faults—the Cucapas, San Jacinto, and Imperial—belong to the San Andreas system. Development of geothermal energy as a source of electricity in the Valle de Mexicali is discussed; at Cerro Prieto, one well (M–3) is in production, another (M–4) is being developed. These and several nonproductive wells are shown in relation to the San Jacinto and other faults, and to isotherms of the area.—V.M.J.

0658 **Anderson, Daniel Harvie.** Uranium–thorium–lead ages of zircons and model lead ages of feldspars from the Saganaga, Snowbank and Giants Range Granites of northeastern Minnesota [abs.]: Dissert. Abs., v. 26, no. 1, p. 308, 1965.

Anderson, Don L. *See* Niazi, Mansour. 0635

0667 **Anderson, Henry W.; Wallis, James R.** Some interpretations of sediment sources and causes, Pacific Coast basins in Oregon and California, *in* Federal Inter-Agency Sedimentation Conf., Jackson, Miss., 1963, Proc., Symposium 1—Land erosion and control: U.S. Dept. Agriculture Misc. Pub. 970, p. 22–30, tables, 1965.

Differences in sediment discharges from watersheds can be attributed to differences in erosion from their slopes and channels and to differences in transport of eroded material. Between and within watersheds, the discharges vary in response to differences in streamflow, soils, topography, and land use. An evaluation is made of these factors in the Pacific Coast basin, tables are included on the relation of soil erodibility indexes—dispersion ratio and surface-aggregation ratio—to rock type, and on coefficients of interaction of cover and rock type on surface-aggregation ratio in northern California.—G.D.C.

0672 **Anderson, Orson L.** An approximate method of estimating shear velocity from specific heat: Jour. Geophys. Research, v. 70, no. 18, p. 4726–4728, illus., table, 1965.

It is shown that isotropic shear velocity (v_s) of inorganic materials such as minerals and rocks can be estimated from low-temperature specific heat measurements. This permits determination of shear velocity without regard to the state of aggregation of the samples. The method is based on the lattice dynamic principle that at sufficiently low temperatures the vibrational energy results solely from acoustic vibrations. An equation is given by means of which v_s can be computed if the mean atomic weight, density, and low-temperature specific heat are known; this

technique is as accurate as other standard techniques for measuring v_s in rocks and crystals.—D.B.V.

0958 **Anderson, T. B.** Turbidites whose sole markings show more than one trend—A further interpretation: Jour. Geology, v. 73, no. 5, p. 812–814, illus., 1965.

Turbidites with sole markings that indicate two or more directions of flow suggest that the underlying shale bed has been exposed and covered repeatedly by turbidity currents moving in different directions.—E.T.R.

Andrews, J. T. *See* Falconer, G. 0666

0492 **Arenal C., Rodolfo del.** Estudio geológico para localización de yacimientos de carbón en el área Ojinaga–San Carlos, Estado de Chihuahua, Mexico: Asoc. Mexicana Geólogos Petroleros Bol., v. 16, nos. 5–6, p. 121–142, illus., table, 1964.

Geologic exploration of the Ojinaga–San Carlos area, in northeastern Chihuahua, has revealed a thick stratigraphic column, composed chiefly of Cretaceous sedimentary rocks. Igneous rocks, extrusive and intrusive, with complex folding and faulting, represent five periods of volcanic and tectonic activity, from pre-Permian to upper Tertiary, the last two being orogenic. Bituminous coal deposits have been found in the Upper Cretaceous Aguja Formation. Analyses show that the coal can be exploited commercially if a washing process can be developed to reduce high ash and volatile contents. The area of possible exploitation has been localized to a narrow syncline extending between Mina del Carbón and Rancho San José. Recoverable reserves are calculated at 7 million tons.—V.M.J.

0947 **Arnal, Robert E.** Ecology of San Francisco Bay [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 49, no. 7, p. 1078, 1965.

Ault, W. U. *See* Murata, K. J. 0526

0946 **Backus, Milo M.** Seismological signal processing [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 49, no. 7, p. 1079, 1965.

Bailey, E. G. *See* Garling, M. E. 0856

Baker, Melville, Jr. *See* Krivoy, Harold L. 0866

0523 **Baker, R. C.** Reconnaissance investigation of the ground-water resources of the lower Rio Grande Basin, Texas: Texas Water Comm. Bull. 6502, p. L1–L34, illus., tables, 1965.

The area lies in the extreme southern part of the State along the Rio Grande from Webb County, 15 mi south of Laredo, to the Gulf of Mexico, and includes outcropping units of Tertiary and Quaternary age. The major aquifer is the Quaternary alluvium made up of terrace, flood-plain, and delta deposits. Reserves are not indicated but pumpage rate from 84 irrigation wells in 1961 was about 1 million gal per day. Secondary aquifers are Tertiary rocks including the Catahoula Tuff, Oakville Sandstone, Lagarto Clay, Goliad Sand, and Willis Sand, and a Quaternary rock, the Lissie Formation, which supply water for livestock watering, domestic use, and drilling oil wells.—M.C.

0668 **Baker, R. C.; Baum, G. H.** Ground-water conditions in Menard County, Texas: Texas Water Comm. Bull. 6519, 92 p., illus., tables, 1965.

Ground water is a significant source of water for all purposes in the county and comes largely from the Edwards and associated Limestones (Mesozoic) but also from Quaternary alluvium, the Trinity Group (Mesozoic), and Paleozoic rocks. Most water is very hard but suitable for stock watering and domestic use. Recharge comes mainly from precipitation on the outcrop areas. No record is given of water resources and reserves available. Exploration for oil and natural gas has produced many wells and test holes in addition to water wells, all of which supply data on the underlying rocks. The water supply may be subject to pollution from improper plugging of tests or careless disposal of brines.—M.C.

0945 **Baldwin, Thomas A.** Pacific offshore exploration 1949–1965 [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 49, no. 7, p. 1079, 1965.

0970 **Bandy, O. L.** Restrictions of the orbulinid datum [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 49, no. 7, p. 1079, 1965.

0944 **Bandy, Orville L.; Ingle, James C., Jr.; Resig, Johanna M.** Foraminiferal biofacies, Santa Monica Bay, California [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 49, no. 7, p. 1079, 1965.

Barghoorn, E. S. *See* Brush, Grace S. 0475

Barker, J. H. *See* Wahlberg, J. S. 0683

Barnes, I. Lynus. *See* Naughton, John J. 0874

Baum, G. H. *See* Baker, R. C. 0668

0649 **Bayley, Fred, Jr.** Sediment deposits on the cone area of Big Sand Creek, at Valley Hill, Miss., *in* Federal Inter-Agency Sedimentation Conf., Jackson, Miss., 1963, Proc., Symposium 2—Sediment in streams: U.S. Dept. Agriculture Misc. Pub. 970, p. 449–454, illus., 1965.

Big Sand Creek is typical of hill tributaries of the Yazoo River system, which deposit large cone-shaped fills as they enter the flat alluvial valley. Estimates of sediment rates are based on actual field measurements of deposits, which have been computed from a comparison of range profiles of 1920 with those made in 1947 and 1957. Between 1920 and 1947 these deposits amounted to nearly 1,000,000 cu yd, or 583 acre-feet per year. A reduced rate of deposition in the cone area since 1947 is attributed to maintenance of levees, thus more sediment has been transported to the Yazoo River, contributing to its filling in the 50-mile reach below Greenwood.—G.D.C.

0547 **Bayley, Richard W.** Geologic map of the Louis Lake quadrangle, Fremont County, Wyoming: U.S. Geol. Survey Geol. Quad. Map GQ-461, scale 1:24,000, 1965.

0943 **Beck, R. Stanley.** Biostratigraphic highlights of some deep wells from central-southern San Joaquin Valley, California [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 49, no. 7, p. 1079, 1965.

0942 **Bedford, J. W.** Great Alaskan earthquake and its after effects [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 49, no. 7, p. 1079–1080, 1965.

0665 **Beer, Craig E.; Johnson, Howard P.** Factors related to gully growth in the deep loess area of western Iowa, *in* Federal Inter-Agency Sedimentation Conf., Jackson, Miss., 1963, Proc., Symposium 1—Land erosion and control: U.S. Dept. Agriculture Misc. Pub. 970, p. 37–43, illus., tables, 1965.

Although progress has been made in the control of gullies, the process of gullying has not been defined by quantitative relationships. The area used for this loess study was Steer Creek Watershed in Harrison County. The main gully, over 30 feet deep and 50 feet wide, extends upstream for 10 miles and has many active laterals and sublaterals. Records of 1851 showed no major gully development, only three laterals averaging 3 feet in width; the remaining 26 have developed since 1915. A regressional analysis of gully geometry and topographic variables was made on computer programmed data of lateral development since 1938, and prediction equations were obtained using linear and logarithmic models for the change in gully surface area.—G.D.C.

0985 **Behrens, E. William.** Use of the Goldberg refractometer as a salinometer for biological and geological field work: Jour. Marine Research, v. 23, no. 2, p. 165–171, illus., tables, 1965.

The Goldberg refractometer (model 10402) has been tested as a potential field salinometer. The instrument has a range of zero to 220 parts per thousand and an accuracy of about one ppt. Most salinometers have been designed for extreme accuracy (0.02 ppt) and limited range (0–50 ppt) required by physical oceanographers; however, many marine biologists and geologists need lesser accuracies but higher ranges. For example, salinities in Texas bays may exceed 100 or even 200 ppt. The refractometer has the advantages of temperature compensation, small size, small sample requirements, large range, and low cost.—V.M.J.

Beillie, J. *See* Pye, E. G. 0486

0851 **Belshé, John C.** Magnetic studies of rocks and sediments obtained by deep drilling: Pacific Sci., v. 19, no. 3, p. 393–396, illus., 1965.

Crustal materials found in drilling the Mohole should be geochemically interesting, for magnetic susceptibility, Curie temperature, and magnetic hysteresis and anisotropy may reflect pressure, temperature, and chemical relationships in the crust and upper mantle. Rocks and sediments may have remanent magnetism, acquired in the Earth's field and have paleomagnetic significance. For the proposed site north of Maui, Hawaii, average heat flow value is normal, so that an average conductivity figure of 2×10^{-3} cal/°C sec yields a thermal gradient value of 70°C/km. Since depth to the magnetic Curie isotherm for oceanic basalts probably lies more than 8 km below the sediment surface or too deep for drilling, most material drilled should have thermoremanent magnetization. Guadalupe site studies show the importance of orientation and complete recovery of the core.—M.C.

Belshé, John C. *See* Rose, John C. 0862

0502 **Belt, Edward Scudder.** Stratigraphy and sedimentology of the Mabou Group (middle Carboniferous), Nova Scotia, Canada [abs.]: Dissert. Abs., v. 26, no. 1, p. 308–309, 1965.

0636 **Ben-Menahem, Ari.** Observed attenuation and Q values of seismic surface waves in the upper mantle: Jour. Geophys. Research, v. 70, no. 18, p. 4641–4651, illus., tables, 1965.

Attenuation coefficients and Q values of Love and Rayleigh waves in the period range 50–330 sec have been derived from the amplitude spectrums of these waves, using data on 12 earthquakes. Data from each event indicate a systematically higher attenuation (lower Q) for Love than for Rayleigh waves. Attenuation coefficients for both waves tend to increase linearly with frequency, and corresponding Q functions vary slowly with mean values $Q_L = 105$ and $Q_R = 145$. In contradistinction to phase velocities, there is no evidence for a persistent difference in attenuation of mantle surface waves under oceans and continents.—D.B.V.

0503 **Berger, Richard Lee.** The effect of adsorbed ions on the structural derangement temperature of illite and phlogopite [abs.]: Dissert. Abs., v. 26, no. 1, p. 309, 1965.

0543 **Bergeron, Robert.** Geology and mineral resources of the Labrador Trough: New York Acad. Sci. Trans., ser. 2, v. 27, no. 8, p. 843–857, illus., table, 1965.

This sub-province of the Canadian Shield, through the heart of the Quebec Labrador peninsula from Ungava Bay to Ossokmanuan Lake, has a folded sequence of sedimentary, volcanic and intrusive rocks resting on granitic rocks. It is described in three parts—southern, central, and northern. A brief history is given of exploration after the first reported mineral wealth by Father Louis Babel in 1866. By the end of 1950, 418 million tons of hematite-goethite ore had been discovered in the southern part, in the Ruth and Sokoman Formations. Occurrences of sulfide minerals are widespread but below economic grade. A large tonnage of low-grade iron ore in the central part is too remote from the sea; potential deposits of a little higher grade are found in the northern part, along with interesting copper-nickel deposits.—G.D.C.

0902 **Berggren, W. A.** Paleocene—A micropaleontologist's point of view: Am. Assoc. Petroleum Geologists Bull., v. 49, no. 9, p. 1473–1484, table, 1965.

An historical summary is presented of the original definition, early and subsequent usage, and present conflicting concepts of the term Paleocene. Recent studies on planktonic foraminifers and coccolithophorids have resulted in a biostratigraphic zonation of the Paleocene which can be correlated with sufficient accuracy with the type localities of the classic stages of western Europe. . . .—Author's abstract

0655 **Berner, Robert A.** Activity coefficients of bicarbonate, carbonate, and calcium ions in sea water: Geochim. et Cosmochim. Acta, v. 29, no. 8, p. 947–965, tables, 1965.

Measurements of pH of sea water samples equilibrated with known partial pressures of CO_2 and with calcite and aragonite have enabled the determination of molal activity coefficients for bicarbonate, carbonate, and Ca ions in two sea water samples at 25°C and 1 atm total pressure. The results indicate the essential validity of Garrels and Thompson's model (Am. Jour. Sci., v. 260, p. 57–66, 1962). As first approximation these values can be used to represent the whole ocean. It is shown that low-latitude surface sea water is supersaturated with respect to both calcite and aragonite and that a large proportion of subsurface sea water is undersaturated with respect to all forms of $CaCO_3$.—D.B.V.

0661 **Berner, Robert A.** Distribution and diagenesis of sulfur in some sediments from the Gulf of California: Marine Geology, v. 1, no. 2, p. 117–140, illus., tables, 1964.

Depth distribution of the following forms of sulfur have been determined from five Recent sediment cores from central Gulf of California: sulfide, elemental sulfur, sulfate, and pyrite (plus organic sulfur). Chemical analysis methods for each form are discussed. The most abundant form is pyrite, commonly more than 10,000 ppm sulfur by dry weight of sediment. Concentrations of total sulfur in excess of that expected from simple burial of sea water suggest that the sediment acts as a chemically open system to the sulfate of the overlying water. Dissolved sulfate and sulfide show monotonic decreases and increases, respectively, with depth in the cores. Absence of black FeS is due to rapid transformation to pyrite at the sediment-water interface.—V.M.J.

0950 **Berry, Keith D.** New foraminiferal zonation, upper Mesozoic, Sacramento Valley, California [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 49, no. 7, p. 1080, 1965.

Bickford, M. E. *See* Wetherill, G. W. 0671

0607 **Biehler, Shawn.** Gravity studies in southern California: Am. Geophys. Union Trans., v. 46, no. 3, p. 557–560, illus., 1965.

The areas of published and unpublished gravity coverage and surveys in progress in southern California, made by the Caltech group, are shown in a sketch map keyed to references.—D.B.V.

Bielen, H. J. *See* Lowman, F. G. 0692

0564 **Bierschenk, William H.** Determining well efficiency by multiple step-drawdown tests [with French abstract]: Internat. Assoc. Sci. Hydrology Pub. 64, p. 493–507, illus., tables, 1964.

Graphical solution of multiple step-drawdown test data permits the approximate determination of two components of drawdown in a pumped well, namely, that due to formation loss and that due to well loss. Comparisons were made of data from tests made on wells tapping fluviatile and glaciofluviatile deposits respectively in Iran and southeastern Washington. Climatic conditions were semi-arid and ground water occurred under water-table conditions and occasionally under artesian conditions in both areas. Results indicate that the efficiency of a well is governed largely by magnitude of well loss and that it falls off rapidly as discharge is increased. Efficiency of a well in an aquifer with high transmissibility is affected more by well

loss than is that of a well in an aquifer with low transmissibility; it is affected least by partial penetration of aquifers having a large transmissibility.—M.C.

0941 **Billman, Harold G.** Review of Tertiary stratigraphy and foraminiferal zonations of western Washington State [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 49, no. 7, p. 1080–1081, 1965.

Bingham, E. *See* Albee, A. L. 0686

0553 **Blankenship, Reginald R.** Reconnaissance of the ground-water resources of the Southport-Elizabethtown area, North Carolina: North Carolina Dept. Water Resources Ground-Water Bull. 6, 47 p., illus., tables, 1965.

The area is a flat sandy plain in the Coastal Plain Province, underlain by Cretaceous to Recent sediments. The principal aquifers from oldest to youngest are the Black Creek and Peedee Formations (Cretaceous), the Castle Hayne Limestone and Duplin Marl, both of Tertiary age, and unnamed surficial deposits of Quaternary age. Total pumpage is estimated at 5 million gal per day, only a small fraction of the amount available. Water in Cretaceous formations is soft and of good quality but becomes brackish with depth towards the coast and water from the Tertiary rocks contains iron which may occur in objectionable amounts locally.—M.C.

0525 **Blow, W. H.** *Clavatorella*, a new genus of the Globorotaliidae: Micropaleontology, v. 11, no. 3, p. 365–368, illus., 1965.

Loeblich and Tappan recently (1964) assigned the genus *Beella* Banner and Blow, 1960, to the subfamily Globigerininae; a reinvestigation of the type species of this genus, *Globigerina digitata* Brady, 1879, shows this to be correct. A new generic name is required for those species which have an interiomarginal, umbilical-extraumbilical aperture and not a purely interiomarginal umbilical aperture, but which, like those included in *Beella*, are trochospirally coiled. *Clavatorella*, new genus—type species: *Hastigerinella bermudezi* Bolli, 1957— is proposed for those trochospiral species which have radially elongate chambers and an aperture which is interiomarginal, umbilical-extraumbilical in position.—Author's abstract

Blow, W. H. *See* Eames, F. E. 0858

0603 **Bolt, Bruce A.** Travel-time tables for the seismic wave PKP: Nature, v. 207, no. 5000, p. 967–969, tables, 1965.

Revised PKP traveltime tables are presented, based on nuclear explosion data. These tables represent smoothed empirical times and do not depend on any particular assumed velocity distribution in the core. However, Bolt's T2 velocity distribution (1964) predicts these times to about 1 sec.—D.B.V.

0697 **Bondesen, Erling; Petersen, Ole Valdemar.** Axinite from Greenland: Dansk Geol. Foren. Medd., v. 15, no. 4, p. 562–567, illus., tables, 1965; reprinted as Grønlands Geol. Undersøgelse Misc. Paper 45, 1965.

Axinite, a rare boron-bearing calc-silicate, has been found as a vein mineral, with calcite and quartz, in a single pillow of a Precambrian pillow-lava (Foselv Formation of Sortis Group), between Arsuk and Sermiligarssuk Fjords in the Frederikshaab District of South Greenland. Optical, chemical, and X-ray data are given. Most axinite occurs in contact metamorphosed calcareous sediments and contact aureoles of intrusive granites involving calcareous material; it is rare in areas of regional metamorphism. The axinite here described cannot be a result of contact metamorphism of calcareous veins, as there are no younger intrusives nearby. It must have been formed either immediately after solidification of the pillow-lava, possibly by metasomatic vein filling, or during later regional metamorphism.—V.M.J.

0981 **Bondesen, Erling; Henriksen, Niels.** On some pre-Cambrian metadolerites from the central Ivigtut region, SW Greenland: Medd. om Grønland, v. 179, no. 2, 42 p., illus., geol. map, 1965; reprinted as Grønlands Geol. Undersøgelse Bull. 52, 1965.

The map area covered is in the west-central part of the Ivigtut region of South Greenland (the mainland and islands west of Arsuk Fjord). Occurrence and petrology of the Kuanitic dikes are described, and the chronology of the Kuanitic period (Precambrian) in its type area is interpreted. The Ketilidian gneisses were intruded by several generations of tensional doleritic dikes—the Kuanitic dikes. During the Sanerutian period, the dikes were metamorphosed in six stages with alteration increasing from west to east. Along a specific metadolerite traced for about 40 km, the metamorphic grade changes, eastward, from high greenschist facies to epidote-amphibolite facies. In the west, static conditions prevailed during the alteration; in the east, as indicated by the Sanerutian shear zones, dynamic conditions prevailed.—V.M.J.

0609 **Bonini, William E.** Gravity surveys in the northwestern United States: Am. Geophys. Union Trans., v. 46, no. 3, p. 563–569, illus., table, 1965.

The Princeton University gravity program in northwestern United States is summarized, and areas being studied in Washington by the University of Puget Sound are listed. More than 6,000 stations have been observed since 1955. Locations of areas of published and unpublished coverage and surveys in progress in Washington, Oregon, Idaho, Montana, and Wyoming are shown in a sketch map keyed to references. Other maps show Bouguer anomalies, isostatic corrections, and isostatic anomalies for the 5-state area.—D.B.V.

0582 **Bouma, Arnold H.** Self-locking compass: Marine Geology, v. 1, no. 2, p. 181–186, illus., 1964.

A self-locking compass has been designed to determine the orientation of submarine sediment cores obtained by the box core sampler; it can be mounted on any other oceanographic coring device where a single orientation is desired. Accuracy is within 5°. The obtained orientation is locked by a tripping part. The instrument was developed in connection with work at the Scripps Institution of Oceanography, La Jolla, Calif.—V.M.J.

0940 **Bowen, Oliver E.** Stratigraphy, structure, and oil possibilities in Monterey and Salinas quadrangles, California [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 49, no. 7, p. 1081, 1965.

0739 **Boynton, G. R.; Popenoe, Peter; Zandle, G. L.** Aeromagnetic map of the Egremont quadrangle and part of the State Line quadrangle, Berkshire County, Massachusetts and Columbia County, New York: U.S. Geol. Survey Geophys. Inv. Map GP-529, scale 1:24,000, 1965.

The aeromagnetic survey of the Egremont and State Line quadrangles was flown at 500 feet above ground; contour intervals are 20 and 100 gammas.—M.C.M.

0740 **Boynton, G. R.; Popenoe, Peter; Zandle, G. L.** Aeromagnetic map of the Blandford quadrangle, Hampden and Hampshire Counties, Massachusetts: U.S. Geol. Survey Geophys. Inv. Map GP-528, scale 1:24,000, 1965.

The aeromagnetic survey of the Blandford quadrangle was flown at 500 feet above ground; contour intervals are 20 and 100 gammas.—M.C.M.

0742 **Boynton, G. R.; Popenoe, Peter; Zandle, G. L.** Aeromagnetic map of the Woronoco quadrangle, Hampden and Hampshire Counties, Massachusetts: U.S. Geol. Survey Geophys. Inv. Map GP-537, scale 1:24,000, 1965.

The aeromagnetic survey of the Woronoco quadrangle was flown at 500 feet above ground; contour interval is 20 gammas.—M.C.M.

0580 **Bredehoeft, J. D.; Papadopulos, I. S.** Rates of vertical groundwater movement estimated from the Earth's thermal profile: Water Resources Research, v. 1, no. 2, p. 325–328, illus., table, 1965.

An analytical solution is developed describing vertical steady flow of groundwater and heat through an isotropic, homogeneous, and fully saturated semiconfining

layer. A type-curve method for estimating groundwater velocities from temperature data is presented—Authors' abstract

0568 **Bredehoeft, John D.; Farvolden, R. N.** Disposition of aquifers in intermontane basins of northern Nevada [with French abstract]: Internat. Assoc. Sci. Hydrology Pub. 64, p. 197–212, illus., tables, 1964.

The area is a small portion of the Great Basin and contains long alluvial valleys, which are underlain by clastic sediments derived from adjacent highlands and are areas of potential ground-water development, with less than 50 percent of their estimated perennial yield developed. Lithofacies maps were compiled from drillers' logs. Extensive gravel deposits are the best aquifers, are associated with the major streams, and probably were deposited during an earlier period of pluvial climate. Their median permeability value is approximately 500 gpd per square foot, using the calculated specific capacity for 22 of the best wells in the deposits.—M.C.

0939 **Brooks, Richard L.** Review of biostratigraphy of Los Angeles basin [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 49, no. 7, p. 1081, 1965.

Brucker, Roger W. *See* Nicholas, G. 0618

0475 **Brush, Grace S.; Barghoorn, E. S.** On "The natural relationships of some Carboniferous microspores"—A reply [to discussion by L. R. Moore, 1965]: Jour. Paleontology, v. 39, no. 4, p. 732–733, 1965.

The authors show that L. R. Moore's (ibid., v. 39, no. 2, p. 296–297, 1965) and their own conclusions regarding spore development are based on different plants. They reiterate that spore exine morphology is generally uniform, and urge caution in the use of spore size as a developmental feature.—S.H.M.

0639 **Bruun, Per.** Quantitative tracing of littoral drift, *in* Federal Inter-Agency Sedimentation Conf., Jackson, Miss., 1963, Proc., Symposium 3—Sedimentation in estuaries, harbors, and coastal areas: U.S. Dept. Agriculture Misc. Pub. 970, p. 756–765, illus., 1965.

Littoral drift of sediment is caused by a combination of shear stresses induced by wave action and longshore current, phases of which represent a combination of elements or an integration of single elements. Wave action on barrier-lined coasts causes a longshore current that will be strongest in the breaker and uprush zones. On the unbroken barrier shore this current will be interrupted by rip currents, and on the inlet broken shore by tidal currents. The Coastal Engineering Laboratory of the University of Florida is at present carrying out combined field and laboratory research on friction factors and quantity of drift, using luminophore tracers in the field.—G.D.C.

0906 **Bryant, William R.; Pyle, Thomas E.** Tertiary sediments from Sigsbee Knolls, Gulf of Mexico: Am. Assoc. Petroleum Geologists Bull., v. 49, no. 9, p. 1517–1519, illus., tables, 1965.

Core sampling in 1964 revealed a considerable thickness of nonturbidite Tertiary sediment in the Sigsbee Deep.—W.C.C.

0938 **Burg, Kenneth E.** Geological value of digital processing in highly explored areas [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 49, no. 7, p. 1081–1082, 1965.

0504 **Burk, Creighton Alvin.** Geology and structural history of the Alaska Peninsula [abs.]: Dissert. Abs., v. 26, no. 1, p. 309–310, 1965.

0707 **Burke, Kevin; Williams, J. B.** Effort Bridge metamorphism [discussion of "Field meeting in Central Inlier of Jamaica," by Williams, 1959, and reply by author]: Geonotes, v. 6, no. 1 (Jamaica Geol. Survey Pub. 91), p. 46–47, 1964.

Metamorphism of Cretaceous tuffs at Effort Bridge in the Central Inlier was attributed by Williams (1959) to local thermal metamorphism by andesite dikes. Burke points out that the chlorite-epidote alteration assemblages are more

characteristic of low-grade regional metamorphism and are found in the dikes as well as in the tuffs. Granodiorite crops out near Ginger Ridge in the center of the inlier, and the presence of probably related aplite dikes at Effort Bridge suggests that a body of unexposed granodiorite may underlie the whole area and be the cause of the metamorphism. Williams agrees in part, but points out that alteration in certain dikes can be due to two or more phases of dike intrusion, as in the Sunderland Inlier, where, incidentally, there is no sign of granodiorite or its derivatives.—V.M.J.

0877 **Burnett, O. W.; Mixa, E.** Application of the formation interval tester in the Rocky Mountain area: Am. Petroleum Inst. Drilling and Production Practice 1964, p. 131–140, illus., 1965.

The wireline tester previously used with success in the Gulf Coast area was applied to possible oil-bearing formations in the Rocky Mountain area where local formations generally are of lower porosity and drilling-mud invasion is usually deeper. As a result of over 300 formation tests, it is usually possible now to predict both rates and fluids of production and to estimate formation permeability based on flow rates into the sample recovery chamber. Prediction of production fluids is based on consideration of only those recovered fluids that were present in the formation before the well was drilled.—M.C.

0736 **Burns, Robert E.** Importance of marine influences in estuarine sedimentation, *in* Federal Inter-Agency Sedimentation Conf., Jackson, Miss., 1963, Proc., Symposium 3—Sedimentation in estuaries, harbors, and coastal areas: U.S. Dept. Agriculture Misc. Pub. 970, p. 593–598, illus., 1965.

A simple model is presented which indicates five possible behaviors of sediment introduced into an estuary, and a generalized sketch illustrates the various sources. In areas with longshore and coastal currents outside the estuary, the seaward end is the dominant source. Port San Juan, British Columbia, is an example of the mouth source and marine processes.—G.D.C.

0735 **Bustamante, Jorge I.** Earthquake stability of slopes of cohesionless soils—Discussion [of paper 4128 by H. B. Seed and R. E. Goodman, 1964]: Am. Soc. Civil Engineers Proc., v. 91, paper 4394, Jour. Soil Mechanics and Found. Div., no. SM 4, pt. 1, p. 208–211, illus., 1965.

Seed and Goodman emphasize the problem of designing a test to measure the strength of cohesionless materials under low confining pressures, and cite a sliding test on a plastic block simulating sand to obtain shear strength. In a parallel study at the National University of Mexico, direct shear tests and tilting tests of slopes were comparable to the above tests because no deformation occurred in the interior. There is an inherent instability of granular material once maximum strength is reached, and dispersion of accelerations and velocities of future earthquakes allows the inference that the maximum strength will be reached at some future time. Displacements of the crown are compared for the different tests.—G.D.C.

0480 **Byers, A. R.** James Buckland Mawdsley (1894–1964): Arctic, v. 18, no. 2, p. 146–147, 1965.

0879 **Byrne, John V.** Bathymetry of Crater Lake, Oregon, *in* State of Oregon lunar geological field conf., 1965, Guidebook: Oregon Dept. Geology and Mineral Industries Bull. 57, p. 46–47, illus., reprinted 1965; originally published 1962.

This deepest lake in the United States (1,932 feet) was measured first in 1886, again in 1938–40, and most recently in 1959 in great detail. Use of a 10-fathom contour makes several features of geologic interest apparent. As the runoff and sediment supply are limited there has been little modification of the original surface. The lobe extending eastward from Wizard Island is undoubtedly a lava flow; the conical mound at its inner edge probably a volcanic cone somewhat buried by the lava flow; and rocks dredged from an almost perfect cone that rises to 81 fathoms near the deepest north-central part of the lake consist of hypersthene-augite andesite, whereas those from the mound at the inner edge of the Wizard Island lava flow are vitrophyric hypersthene-hornblende dacite (Williams, 1961).—G.D.C.

Cameron, Alexander R. *See* Hacquebard, Peter A. 0975

0616 **Cameron, Eugene N.** Identification of opaque minerals [discussion of paper by B. H. Flinter, 1965]: Econ. Geology, v. 60, no. 6, p. 1331–1333, 1965.

Problems of ore microscopy discussed by Flinter (Econ. Geology, v. 60, p. 375–380, 1965) are reviewed briefly.—W.S.W.

Campbell, Frank L. *See* Walstrom, John E. 0953

0532 **Canada Geological Survey.** Aeromagnetic map, Burk's Falls, Ontario: Canada Geol. Survey Geophysics Paper 1475, scale 1:63,360, 1965.

0743 **Canada Geological Survey.** Polar Continental Shelf Project, District of Franklin, Sheet 69 F/SW and part of 79 E/SE: Canada Geol. Survey Geophysics Paper 1714, scale 1:126,720, 1965.

0744 **Canada Geological Survey.** Polar Continental Shelf Project, District of Franklin, Sheet 69 F/SE: Canada Geol. Survey Geophysics Paper 1715, scale 1:126,720, 1965.

0745 **Canada Geological Survey.** Polar Continental Shelf Project, District of Franklin, Sheets 69 E/SE and 69 E/SW: Canada Geol. Survey Geophysics Paper 1716, scale 1:126,720, 1965.

0746 **Canada Geological Survey.** Polar Continental Shelf Project, District of Franklin, Sheet 69 F/NW and part of 79 E/NE: Canada Geol. Survey Geophysics Paper 1717, scale 1:126,720, 1965.

0747 **Canada Geological Survey.** Polar Continental Shelf Project, District of Franklin, Sheet 69 F/NE: Canada Geol. Survey Geophysics Paper 1718, scale 1:126,720, 1965.

0748 **Canada Geological Survey.** Polar Continental Shelf Project, District of Franklin, Sheets 69 E/NE and 69 E/NW: Canada Geol. Survey Geophysics Paper 1719, scale 1:126,720, 1965.

0749 **Canada Geological Survey.** Polar Continental Shelf Project, District of Franklin, Sheet 69 G/SW and part of 79 H/SE: Canada Geol. Survey Geophysics Paper 1720, scale 1:126,720, 1965.

0750 **Canada Geological Survey.** Polar Continental Shelf Project, District of Franklin, Sheet 69 G/SE and part of 69 H/SW: Canada Geol. Survey Geophysics Paper 1721, scale 1:126,720, 1965.

0751 **Canada Geological Survey.** Polar Continental Shelf Project, District of Franklin, Sheet 69 G/NW and part of 69 G/NE, 79 H/NE: Canada Geol. Survey Geophysics Paper 1722, scale 1:126,720, 1965.

0752 **Canada Geological Survey.** Polar Continental Shelf Project, District of Franklin, Sheet 1000 B/NE: Canada Geol. Survey Geophysics Paper 3407, scale 1:126,720, 1965.

0753 **Canada Geological Survey.** Polar Continental Shelf Project, District of Franklin, Sheet 1000 A/NW: Canada Geol. Survey Geophysics Paper 3408, scale 1:126,720, 1965.

0754 **Canada Geological Survey.** Polar Continental Shelf Project, District of Franklin, Sheet 1000 A/NE: Canada Geol. Survey Geophysics Paper 3409, scale 1:126,720, 1965.

0755 **Canada Geological Survey.** Polar Continental Shelf Project, District of Franklin, Sheet 780 B/NW: Canada Geol. Survey Geophysics Paper 3410, scale 1:126,720, 1965.

0756 **Canada Geological Survey.** Polar Continental Shelf Project, District of Franklin, Sheet 1000 B/SE: Canada Geol. Survey Geophysics Paper 3411, scale 1:126,720, 1965.

0757 **Canada Geological Survey.** Polar Continental Shelf Project, District of Franklin, Sheet 1000 A/SW: Canada Geol. Survey Geophysics Paper 3412, scale 1:126,720, 1965.

0758 **Canada Geological Survey.** Polar Continental Shelf Project, District of Franklin, Sheet 1000 A/SE: Canada Geol. Survey Geophysics Paper 3413, scale 1:126,720, 1965.

0759 **Canada Geological Survey.** Polar Continental Shelf Project, District of Franklin, Sheet 780 B/SW: Canada Geol. Survey Geophysics Paper 3414, scale 1:126,720, 1965.

0760 **Canada Geological Survey.** Polar Continental Shelf Project, District of Franklin, Sheet 99 G/NW: Canada Geol. Survey Geophysics Paper 3415, scale 1:126,720, 1965.

0761 **Canada Geological Survey.** Polar Continental Shelf Project, District of Franklin, Sheet 99 G/NE: Canada Geol. Survey Geophysics Paper 3416, scale 1:126,720, 1965.

0762 **Canada Geological Survey.** Polar Continental Shelf Project, District of Franklin, Sheet 99 H/NW: Canada Geol. Survey Geophysics Paper 3417, scale 1:126,720, 1965.

0763 **Canada Geological Survey.** Polar Continental Shelf Project, District of Franklin, Sheet 99 H/NE: Canada Geol. Survey Geophysics Paper 3418, scale 1:126,720, 1965.

0764 **Canada Geological Survey.** Polar Continental Shelf Project, District of Franklin, Sheet 89 G/NW: Canada Geol. Survey Geophysics Paper 3419, scale 1:126,720, 1965.

0765 **Canada Geological Survey.** Polar Continental Shelf Project, District of Franklin, Sheet 99 H/SW and part of 99 G/SE: Canada Geol. Survey Geophysics Paper 3420, scale 1:126,720, 1965.

0766 **Canada Geological Survey.** Polar Continental Shelf Project, District of Franklin, Sheet 99 H/SE: Canada Geol. Survey Geophysics Paper 3421, scale 1:126,720, 1965.

0767 **Canada Geological Survey.** Polar Continental Shelf Project, District of Franklin, Sheet 89 G/SW: Canada Geol. Survey Geophysics Paper 3422, scale 1:126,720, 1965.

0768 **Canada Geological Survey.** Polar Continental Shelf Project, District of Franklin, Sheet 99 E/NE: Canada Geol. Survey Geophysics Paper 3423, scale 1:126,720, 1965.

0769 **Canada Geological Survey.** Polar Continental Shelf Project, District of Franklin, Sheet 89 F/NW: Canada Geol. Survey Geophysics Paper 3424, scale 1:126,720, 1965.

0770 **Canada Geological Survey.** Polar Continental Shelf Project, District of Franklin, Sheet 89 F/NE: Canada Geol. Survey Geophysics Paper 3425, scale 1:126,720, 1965.

0771 **Canada Geological Survey.** Polar Continental Shelf Project, District of Franklin, Sheet 89 E/NW: Canada Geol. Survey Geophysics Paper 3426, scale 1:126,720, 1965.

0773 **Canada Geological Survey.** Polar Continental Shelf Project, District of Franklin, Sheet 79 F/NW and part of 79 F/NE: Canada Geol. Survey Geophysics Paper 3428, scale 1:126,720, 1965.

0774 **Canada Geological Survey.** Polar Continental Shelf Project, District of Franklin, Sheet 89 F/SW: Canada Geol. Survey Geophysics Paper 3429, scale 1:126,720, 1965.

0775 **Canada Geological Survey.** Polar Continental Shelf Project, District of Franklin, Sheet 89 F/SE: Canada Geol. Survey Geophysics Paper 3430, scale 1:126,720, 1965.

0776 **Canada Geological Survey.** Polar Continental Shelf Project, District of Franklin, Sheet 89 E/SW: Canada Geol. Survey Geophysics Paper 3431, scale 1:126,720, 1965.

0777 **Canada Geological Survey.** Polar Continental Shelf Project, District of Franklin, Sheet 89 E/SE: Canada Geol. Survey Geophysics Paper 3432, scale 1:126,720, 1965.

0778 **Canada Geological Survey.** Polar Continental Shelf Project, District of Franklin, Sheet 79 F/SW and part of 79 F/SE: Canada Geol. Survey Geophysics Paper 3433, scale 1:126,720, 1965.

0779 **Canada Geological Survey.** Polar Continental Shelf Project, District of Franklin, Sheet 89 C/NE: Canada Geol. Survey Geophysics Paper 3434, scale 1:126,720, 1965.

0780 **Canada Geological Survey.** Polar Continental Shelf Project, District of Franklin, Sheet 89 D/NW: Canada Geol. Survey Geophysics Paper 3435, scale 1:126,720, 1965.

0781 **Canada Geological Survey.** Polar Continental Shelf Project, District of Franklin, Sheet 89 D/NE: Canada Geol. Survey Geophysics Paper 3436, scale 1:126,720, 1965.

0782 **Canada Geological Survey.** Polar Continental Shelf Project, District of Franklin, Sheet 79 C/NW and part of 79 C/NE: Canada Geol. Survey Geophysics Paper 3437, scale 1:126,720, 1965.

0783 **Canada Geological Survey.** Polar Continental Shelf Project, District of Franklin, Sheet 89 D/SW and part of 89 C/SE: Canada Geol. Survey Geophysics Paper 3438, scale 1:126,720, 1965.

0784 **Canada Geological Survey.** Polar Continental Shelf Project, District of Franklin, Sheet 89 D/SE: Canada Geol. Survey Geophysics Paper 3439, scale 1:126,720, 1965.

0785 **Canada Geological Survey.** Polar Continental Shelf Project, District of Franklin, Sheet 79 C/SW: Canada Geol. Survey Geophysics Paper 3440, scale 1:126,720, 1965.

0786 **Canada Geological Survey.** Polar Continental Shelf Project, District of Franklin, Sheet 79 C/SE: Canada Geol. Survey Geophysics Paper 3441, scale 1:126,720, 1965.

0787 **Canada Geological Survey.** Polar Continental Shelf Project, District of Franklin, Sheet 79 B/NW: Canada Geol. Survey Geophysics Paper 3443, scale 1:126,720, 1965.

0788 **Canada Geological Survey.** Polar Continental Shelf Project, District of Franklin, Sheet 79 B/NE: Canada Geol. Survey Geophysics Paper 3444, scale 1:126,720, 1965.

0789 **Canada Geological Survey.** Polar Continental Shelf Project, District of Franklin, Sheet 79 A/NW: Canada Geol. Survey Geophysics Paper 3445, scale 1:126,720, 1965.

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0790 **Canada Geological Survey.** Polar Continental Shelf Project, District of Franklin, Sheet 89 A/SE: Canada Geol. Survey Geophysics Paper 3446, scale 1:126,720, 1965.

0791 **Canada Geological Survey.** Polar Continental Shelf Project, District of Franklin, Sheet 79 B/SW: Canada Geol. Survey Geophysics Paper 3447, scale 1:126,720, 1965.

0792 **Canada Geological Survey.** Polar Continental Shelf Project, District of Franklin, Sheet 79 B/SE: Canada Geol. Survey Geophysics Paper 3448, scale 1:126,720, 1965.

0793 **Canada Geological Survey.** Polar Continental Shelf Project, District of Franklin, Sheet 79 A/SW and part of 79 A/SE: Canada Geol. Survey Geophysics Paper 3449, scale 1:126,720, 1965.

0794 **Canada Geological Survey.** Polar Continental Shelf Project, District of Franklin, Sheet 78 G/NW: Canada Geol. Survey Geophysics Paper 3450, scale 1:126,720, 1965.

0795 **Canada Geological Survey.** Polar Continental Shelf Project, District of Franklin, Sheet 78 G/NE: Canada Geol. Survey Geophysics Paper 3451, scale 1:126,720, 1965.

0796 **Canada Geological Survey.** Polar Continental Shelf Project, District of Franklin, Sheet 78 H/NW and part of 78 H/NE: Canada Geol. Survey Geophysics Paper 3452, scale 1:126,720, 1965.

0797 **Canada Geological Survey.** Polar Continental Shelf Project, District of Franklin, Sheet 78 G/SW: Canada Geol. Survey Geophysics Paper 3453, scale 1:126,720, 1965.

0798 **Canada Geological Survey.** Polar Continental Shelf Project, District of Franklin, Sheet 78 G/SE and part of 78 F/NE: Canada Geol. Survey Geophysics Paper 3454, scale 1:126,720, 1965.

0799 **Canada Geological Survey.** Polar Continental Shelf Project, District of Franklin, Sheet 78 H/SW and part of 78 H/SE: Canada Geol. Survey Geophysics Paper 3455, scale 1:126,720, 1965.

0800 **Canada Geological Survey.** Aeromagnetic map, Lac Deleuze, Quebec: Canada Geol. Survey Geophysics Paper 1989, scale 1:63,360, 1965.

0801 **Canada Geological Survey.** Aeromagnetic map, Île Lémoine, Quebec: Canada Geol. Survey Geophysics Paper 1990, scale 1:63,360, 1965.

0802 **Canada Geological Survey.** Aeromagnetic map, Île Peuvereau, Quebec: Canada Geol. Survey Geophysics Paper 1991, scale 1:63,360, 1965.

0803 **Canada Geological Survey.** Aeromagnetic map, Lac Woollett, Quebec: Canada Geol. Survey Geophysics Paper 1992, scale 1:63,360, 1965.

0804 **Canada Geological Survey.** Aeromagnetic map, Lac Thereau, Quebec: Canada Geol. Survey Geophysics Paper 1993, scale 1:63,360, 1965.

0805 **Canada Geological Survey.** Aeromagnetic map, Lac Michaux, Quebec: Canada Geol. Survey Geophysics Paper 1994, scale 1:63,360, 1965.

0806 **Canada Geological Survey.** Aeromagnetic map, Lac Labouillerie, Quebec: Canada Geol. Survey Geophysics Paper 1995, scale 1:63,360, 1965.

0807 **Canada Geological Survey.** Aeromagnetic map, Lac Lavigne, Quebec: Canada Geol. Survey Geophysics Paper 1996, scale 1:63,360, 1965.

0808 **Canada Geological Survey.** Aeromagnetic map, Lac Sazinou, Quebec: Canada Geol. Survey Geophysics Paper 1997, scale 1:63,360, 1965.

0809 **Canada Geological Survey.** Aeromagnetic map, Lac des Antons, Quebec: Canada Geol. Survey Geophysics Paper 1998, scale 1:63,360, 1965.

0810 **Canada Geological Survey.** Aeromagnetic map, Lac Dutilly, Quebec: Canada Geol. Survey Geophysics Paper 1999, scale 1:63,360, 1965.

0811 **Canada Geological Survey.** Aeromagnetic map, Lac Claverie, Quebec: Canada Geol. Survey Geophysics Paper 2000, scale 1:63,360, 1965.

0812 **Canada Geological Survey.** Aeromagnetic map, Lac Linné, Quebec: Canada Geol. Survey Geophysics Paper 2001, scale 1:63,360, 1965.

0813 **Canada Geological Survey.** Aeromagnetic map, Lac Grenier, Quebec: Canada Geol. Survey Geophysics Paper 2002, scale 1:63,360, 1965.

0814 **Canada Geological Survey.** Aeromagnetic map, Île Tchapahipane, Quebec: Canada Geol. Survey Geophysics Paper 2003, scale 1:63,360, 1965.

0815 **Canada Geological Survey.** Aeromagnetic map, Lac Fromenteau, Quebec: Canada Geol. Survey Geophysics Paper 2004, scale 1:63,360, 1965.

0816 **Canada Geological Survey.** Aeromagnetic map, Lac Gochigami, Quebec: Canada Geol. Survey Geophysics Paper 2005, scale 1:63,360, 1965.

0817 **Canada Geological Survey.** Aeromagnetic map, Lac Chamic, Quebec: Canada Geol. Survey Geophysics Paper 2006, scale 1:63,360, 1965.

0818 **Canada Geological Survey.** Aeromagnetic map, Lac Autric, Quebec: Canada Geol. Survey Geophysics Paper 2007, scale 1:63,360, 1965.

0819 **Canada Geological Survey.** Aeromagnetic map, Lac Planat, Quebec: Canada Geol. Survey Geophysics Paper 2008, scale 1:63,360, 1965.

0820 **Canada Geological Survey.** Aeromagnetic map, Lac Quentin, Quebec: Canada Geol. Survey Geophysics Paper 2009, scale 1:63,360, 1965.

0821 **Canada Geological Survey.** Aeromagnetic map, Lac Boisseau, Quebec: Canada Geol. Survey Geophysics Paper 2010, scale 1:63,360, 1965.

0822 **Canada Geological Survey.** Aeromagnetic map, Lac Verreault, Quebec: Canada Geol. Survey Geophysics Paper 2011, scale 1:63,360, 1965.

0823 **Canada Geological Survey.** Aeromagnetic map, Lac Pauli, Quebec: Canada Geol. Survey Geophysics Paper 2012, scale 1:63,360, 1965.

0824 **Canada Geological Survey.** Aeromagnetic map, Lac des Passes, Quebec: Canada Geol. Survey Geophysics Paper 2013, scale 1:63,360, 1965.

0825 **Canada Geological Survey.** Aeromagnetic map, Lac Tournemine, Quebec: Canada Geol. Survey Geophysics Paper 2014, scale 1:63,360, 1965.

0826 **Canada Geological Survey.** Aeromagnetic map, Lac Kallio, Quebec: Canada Geol. Survey Geophysics Paper 2015, scale 1:63,360, 1965.

0827 **Canada Geological Survey.** Aeromagnetic map, Île Ste-Marie, Quebec: Canada Geol. Survey Geophysics Paper 2016, scale 1:63,360, 1965.

0828 **Canada Geological Survey.** Aeromagnetic map, Lac Holton, Quebec: Canada Geol. Survey Geophysics Paper 2017, scale 1:63,360, 1965.

0829 **Canada Geological Survey.** Aeromagnetic map, Lac Mantouchiche, Quebec: Canada Geol. Survey Geophysics Paper 2018, scale 1:63,360, 1965.

0830 **Canada Geological Survey.** Aeromagnetic map, Lac Mabille, Quebec: Canada Geol. Survey Geophysics Paper 2019, scale 1:63,360, 1965.

0831 **Canada Geological Survey.** Aeromagnetic map, Lac Cadieux, Quebec: Canada Geol. Survey Geophysics Paper 2020, scale 1:63,360, 1965.

0832 **Canada Geological Survey.** Aeromagnetic map, Lac Ochiltrie, Quebec: Canada Geol. Survey Geophysics Paper 2021, scale 1:63,360, 1965.

0833 **Canada Geological Survey.** Aeromagnetic map, Lac Pigeon, Quebec: Canada Geol. Survey Geophysics Paper 2022, scale 1:63,360, 1965.

0834 **Canada Geological Survey.** Aeromagnetic map, Lac Morampont, Quebec: Canada Geol. Survey Geophysics Paper 2023, scale 1:63,360, 1965.

0835 **Canada Geological Survey.** Aeromagnetic map, Lac Gondouin, Quebec: Canada Geol. Survey Geophysics Paper 2024, scale 1:63,360, 1965.

0836 **Canada Geological Survey.** Aeromagnetic map, Lac Daniel, Quebec: Canada Geol. Survey Geophysics Paper 2025, scale 1:63,360, 1965.

0837 **Canada Geological Survey.** Aeromagnetic map, Lac de Vau, Quebec: Canada Geol. Survey Geophysics Paper 2026, scale 1:63,360, 1965.

0838 **Canada Geological Survey.** Aeromagnetic map, Lac Témiscamie, Quebec: Canada Geol. Survey Geophysics Paper 2027, scale 1:63,360, 1965.

0839 **Canada Geological Survey.** Aeromagnetic map, Lac Béthoulat, Quebec: Canada Geol. Survey Geophysics Paper 2028, scale 1:63,360, 1965.

0840 **Canada Geological Survey.** Aeromagnetic map, Lac Léotard, Quebec: Canada Geol. Survey Geophysics Paper 2029, scale 1:63,360, 1965.

0841 **Canada Geological Survey.** Aeromagnetic map, Lac Hippocampe, Quebec: Canada Geol. Survey Geophysics Paper 2030, scale 1:63,360, 1965.

0842 **Canada Geological Survey.** Aeromagnetic map, Lac Barou, Quebec: Canada Geol. Survey Geophysics Paper 2031, scale 1:63,360, 1965.

0843 **Canada Geological Survey.** Aeromagnetic map, Île Bohier, Quebec: Canada Geol. Survey Geophysics Paper 2032, scale 1:63,360, 1965.

0844 **Canada Geological Survey.** Aeromagnetic map, Lac Hécla, Quebec: Canada Geol. Survey Geophysics Paper 2033, scale 1:63,360, 1965.

0845 **Canada Geological Survey.** Aeromagnetic map, Lac Emmanuel, Quebec: Canada Geol. Survey Geophysics Paper 2034, scale 1:63,360, 1965.

0888 **Canada Geological Survey.** British Columbia: Canada Geol. Survey Geol. Maps Index Sheets 92, 93, 94, 103, 104 and 114E, scale 1:1,000,000, revised 1965.

0605 **Caner, B.; Cannon, E. H.** Geomagnetic depth-sounding and correlation with other geophysical data in western North America: Nature, v. 207, no. 5000, p. 927-929, illus., 1965.

Geomagnetic depth sounding, based on the comparison of the variations in the natural geomagnetic field recorded at different locations, is not yet sufficiently developed to permit direct quantitative interpretation but is a powerful tool in conjunction with other geophysical information. Mantle structure in western North America is interpreted here on the basis of geomagnetic depth-sounding, seismic and geothermal data.—D.B.V.

Cannon, E. H. *See* Caner, B. 0605

0535 **Carlson, H. D.** (compiler) Fire River sheet, District of Algoma: Ontario Dept. Mines Prelim. Geol. Map P.270, scale 1 in to 2 mi, 1965.

0536 **Carlson, H. D.** (compiler) Elsas sheet, Districts of Cochrane and Algoma: Ontario Dept. Mines Prelim. Geol. Map P.271, scale 1 in to 2 mi, 1965.

Carson, D. J. T. *See* Muller, J. E. 0712

0557 **Cartwright, Keros; Stephenson, David A.** Geological and geophysical investigations for a ground-water supply at Macomb, Illinois: Illinois Geol. Survey Environmental Geology Notes, no. 4, 11 p., illus., 1965.

Electrical resistivity and seismic surveys over the floodplain of the LaMoine River posed problems in interpretation, which required considerable geologic control for solution. The bedrock surface forms a small linear basin 750–1,000 feet wide, oriented approximately east-west, has a maximum relief of 25 feet, and a narrow outlet channel at the side about 500 feet north of the present LaMoine River. Surface deposits are Illinoian glacial drift, loess, and alluvial sediments, underlain by Pennsylvanian shale, in turn underlain by the Mississippian Keokuk and Burlington Formations. The bedrock was not considered as a possible source for water supply because of low permeabilities and deleterious water quality. Geophysical and drilling data delineated an alluvial aquifer system, judged inadequate for the required supply.—M.C.

0937 **Casey, Richard.** Radiolarian ecology in waters off California coast [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 49, no. 7, p. 1082, 1965.

0602 **Chaklader, A. C. D.** The Mohorovičić discontinuity: Nature, v. 207, no. 5001, p. 1082–1083, illus., tables, 1965.

Results of pressure experiments on some natural rocks and clay minerals usually present in the Earth's crust suggest that the higher density of the Mohorovičić layer may be due to the effect of pressure (10–100 kb) at the temperatures of decomposition and phase transformation where the natural minerals are unstable and particularly susceptible to densification.—D.B.V.

0528 **Chamberlain, J. A.; Delabrio, R. N.** Makinawite and valleriite in the Muskox intrusion: Am. Mineralogist, v. 50, nos. 5–6, p. 682–695, illus., tables, 1965.

Makinawite (about FeS) and valleriite (about $CuFeS_2$) occur in the dunites and pyroxenites of the central layered series. Electron-probe measurements, X-ray powder data, optical, and physical properties are presented. Makinawite replaces pentlandite. Valleriite replaces secondary magnetite. Makinawite formed before valleriite and both formed at submagmatic temperatures during and as a result of serpentinization.—E.H.R.

0895 **Chatfield, John.** Petroleum geology of the Greater Red Wash area, Uintah County, Utah: Mtn. Geologist, v. 2, no. 3, p. 115–121, illus., 1965.

The Greater Red Wash area is the largest oil and gas field in the Uinta Basin. The Douglas Creek and Garden Gulch Members of the Green River Formation form a lacustrine delta in the area and yield hydrocarbons from a complex network of discrete sandstones. Each individual sandstone body forms its own stratigraphic trap. Structural features in the area were formed late in Red Wash geologic history (post-Duchesne River) and serve to localize oil and gas in the updip portions of individual sandstones. Estimated ultimate production in the area may total more than 100 million barrels of oil.—Author's abstract

0622 **Chaves, Jesse R.; Schuster, Robert L.** Use of aerial color photography in materials surveys: Natl. Acad. Sci.—Natl. Research Council Highway Research Board, Highway Research Rec. 63 (Pub. 1247), p. 1–9, illus., 1964.

This paper summarizes significant findings in the use of aerial color transparencies in single flight strips taken along major road systems and in other selected locations in Yellowstone National Park. The photographs were taken with a 6-in. focal length Pleogon lens from an average flight height of 3,000 feet. Potential sources of the best appearing construction materials were further investigated in the field and samples taken for laboratory tests. The advantages of color photography for

differentiation of materials is balanced against the lower cost and convenience of work with black and white photography. The quality of color improved with more accurate film exposure and careful printing. Further research needs are suggested, with emphasis on quantitative interpretation.—G.D.C.

0627 **Chen, Ping-fan; Hunter, Richard G.; Erwin, Robert B.** Some low-alumina quartzitic sandstones in West Virginia—A preliminary report: West Virginia Geol. and Econ. Survey Circ. 1, 13 p., illus., table, 1965.

High-silica sandstones suitable for industrial use are known in the State from all but the Ordovician and Permian Systems. New data are presented on rocks of this type in the northeastern, eastern, and southern border areas and a summary is given of known data on low-alumina, high-silica quartzitic rocks from the Tuscarora, Healing Springs, and Oriskany Sandstones. Each of these units appears to contain sufficient reserves for commercial exploitation with the possible exception of the Healing Springs. Spectrographic analyses revealed the presence of Al, Fe, Ti, Mg, Ca, and Zr oxides in addition to 98–99 percent quartz.—M.C.

0601 **Chepil, W. S.** Function and significance of wind in sedimentology, *in* Federal Inter-Agency Sedimentation Conf. Jackson, Miss., 1963, Proc., Symposium 1—Land erosion and control: U.S. Dept. Agriculture Misc. Pub. 970, p. 89–94, illus., tables, 1965.

The action of wind on soil—removal, deposition, and mixing—is mostly in arid regions, but deposition extends into humid regions. Erosion of soil includes saltation, surface creep, and suspension. Dust lifted by turbulent winds is carried high and deposited in uniform layers far from its source; fine dust may circle the Earth many times, and when freshly deposited, its composition is like that of Pleistocene loess. During the last 40 years an estimated average of 1.2 inches of soil has been removed from about 750,000 square miles of the Great Plains. In one semiarid portion, an average of 9 inches was removed from fields that had been cultivated for 20 years; in that time about one-half inch of atmospheric dust was deposited in grassland near the wind-eroded area.—G.D.C.

0634 **Chinnery, M. A.** The vertical displacements associated with transcurrent faulting: Jour. Geophys. Research, v. 70, no. 18, p. 4627–4632, illus., 1965.

Using results of an earlier paper (1961) it is shown that uplift and subsidence accompanying movement on a transcurrent fault may be quite large and may form a complex pattern; permanent vertical deformations of some magnitude also may occur at considerable distances from such a fault. As some faults appear to have very large horizontal movements, these results could be of great significance in geotectonics, and a program of geophysical and geologic investigations to study this effect is suggested.—D.B.V.

Chodos, A. A. *See* Albee, A. L. 0686

Christensen, Bent A. *See* Altschaeffl, A. G. 0578

0723 **Christensen, John H. J.; Ellison, Robert L.** Distribution of Foraminifera in the Patuxent estuary, Maryland [abs.]: Virginia Jour. Sci., new ser., v. 16, no. 4, p. 379, 1965.

0880 **Christiansen, E. A.** Geology and groundwater resources of the Kindersley area (72-N), Saskatchewan: Saskatchewan Research Council Geology Div. Rept. 7, 25 p., illus., tables, geol. map, 1965.

Bedrock consists of Upper Cretaceous rocks and includes from bottom to top the Grizzly Bear Member of the Belly River Formation, Oldman Formation, and Bearpaw Formation, on which electrical log correlations have been made. Preglacial gravel of Tertiary or younger age and Quaternary surficial deposits of drift, till, and lacustrine and fluvial deposits overlie them. Drift and till have been studied for texture and clay and carbonate mineral content. Two glacial advances around 20,000 and 13,000 years ago are indicated. Carbon-14 dates for charcoals and soils are 20,000±850 and 21,000±800 yr B.P. for soils from below tills and 12,240±240

and 10,800±160 yr B.P. respectively for charcoals from below till and in silt. Ground-water aquifers, present in all deposits but the Grizzly Bear, provide adequate water resources.—M.C.

Chronic, John. *See* Murray, F. N. 0593

0708 **Chubb, L. J.** Lucas Barrett [1837–1862]—A biography: Geonotes, v. 6, no. 1 (Jamaica Geol. Survey Pub. 91), p. 3–45, 1964.

Lucas Barrett was Director of the Geological Survey of Jamaica (then the West India Geological Survey) from 1859 to 1862. In this biography, the early history of the Survey is recounted, with discussion of the personal and professional relationship between Barrett and James G. Sawkins (then Assistant Geologist, later Director), and of the geological interpretations attributed to each man. A bibliography of Barrett's publications and related works is appended.—V.M.J.

Chuck, Robert T. *See* Sunn, Franklin Y. K. 0577

0574 **Chun, Robert Y. D.; Weber, Ernest M.; Mido, Kiyoshi.** Computers—Tools for sound management of ground water basins [with French abstract]: Internat. Assoc. Sci. Hydrology Pub. 64, p. 424–437, illus., 1964.

A program has been developed to apply data from analog and digital computers to problems of ground-water basin management. Computers have been used to calculate a mathematical model of a ground-water basin which simulates its storage and transmissive properties. Computers can also be used to evaluate the surface-water supply and distribution and to help correct salt-water intrusion in coastal areas caused by overdrafts. Tests for the Los Angeles County coastal area of California proved that the model could represent a ground-water basin; verification was provided here by the application of historical hydrologic data and the matching historical ground-water table configuration.—M.C.

0936 **Church, Clifford C.** Foraminifera from Lower Cretaceous of Devils Den area, Kern County, California [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 49, no. 7, p. 1082, 1965.

0935 **Church, H. Victor.** Pliocene gas and oil in Semitropic-Trico area, San Joaquin Valley, California [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 49, no. 7, p. 1082, 1965.

0548 **Chute, Newton E.** Surficial geologic map of the Blue Hills quadrangle, Norfolk, Suffolk, and Plymouth Counties, Massachusetts: U.S. Geol. Survey Geol. Quad. Map GQ-463, scale 1:24,000, 1965.

0986 **Cifelli, Richard.** Late Tertiary planktonic Foraminifera associated with a basaltic boulder from the mid-Atlantic Ridge: Jour. Marine Research, v. 23, no. 2, p. 73–87, illus., table, 1965.

A dredge haul from the mid-Atlantic Ridge at lat 22°56′ N., long 46°35′ W. (east of the Caribbean region) yielded partially silicified foraminiferal ooze and fragments of altered basalt. An assemblage of 18 species and subspecies of Foraminifera are illustrated and briefly described from the consolidated ooze; comparison with the assemblage from overlying unconsolidated Quaternary ooze indicates late Tertiary and probably late Miocene age. In the Caribbean region, the index marker *Globorotalia tohsi robusta* is restricted to its zone, while *Globigerina nepenthes* first appears in the overlying zone; in this assemblage they occur together. Correlation with Europe is discussed. Apparently the Tertiary ooze was silicified during later extrusion and alteration of the basalt.—V.M.J.

0524 **Clegg, Kenneth E.** The LaSalle anticlinal belt and adjacent structures in east-central Illinois: Illinois Acad. Sci. Trans., v. 58, no. 2, p. 82–94, illus., 1965.

The belt covers part of five counties in the east-central Illinois basin. Its structural development extends from the time of the Colchester (No. 2) Coal deposition in Middle Pennsylvanian to the present and has been interpreted from an isopach map

of the Carbondale Formation of Pennsylvanian age and from stratigraphic and structural cross-sections, which are based on data from 16 electric logs. Colchester (No. 2) Coal is assumed to have been deposited on an essentially level surface but is now 1,000 feet higher on some parts of the belt than in the adjacent basin areas. About 80 percent of the movement is believed to have occurred after its deposition, but this represents less than half the total movement occurring during the entire structural history of the belt.—M.C.

0505 **Clement, William Glenn.** An investigation of the Earth's gravitational field in the northern San Francisco Bay area, California [abs.]: Dissert. Abs., v. 26, no. 1, p. 310, 1965.

0934 **Clifton, H. Edwards.** Middle and late Miocene paleoslope in southeastern Caliente Range, California [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 49, no. 7, p. 1082, 1965.

0885 **Cobban, W. A.; Jeletzky, J. A.** A new scaphite from the Campanian rocks of the western interior of North America: Jour. Paleontology, v. 39, no. 5, p. 794-801, illus., 1965.

Scaphites gilli, n. sp., a densely ribbed laterally compressed ammonite is described from Wyoming, Colorado, South Dakota, and Montana, in the United States, and Manitoba and Saskatchewan in Canada. The species is assigned to *Hoploscaphites* Nowak, 1912, which is herein treated as a subgenus of *Scaphites* Parkinson, 1811. *Scaphites (Hoploscaphites) gilli* is closely related to the fine ribbed European scaphites usually referred to as *Scaphites roemeri* d'Orbigny. In terms of the standard stages of the Upper Cretaceous, *S. (H.) gilli* occurs in the middle of the upper Campanian. The species first appears in the Western Interior of the United States in the middle of the range zone of *Baculites perplexus*, and ranges on up through the range zones of *Baculites gregoryensis, B. scotti, Didymoceras nebrascense*, and *D. stevensoni*.—Authors' abstract

0933 **Collins, Donald F.; Conner, Donald C.** Brentwood field [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 49, no. 7, p. 1083, 1965.

0663 **Columbus, Nathan.** Viscous model study of sea water intrusion in water table aquifers: Water Resources Research, v. 1, no. 2, p. 313-323, illus., 1965.

An equation is developed for the length of sea water intrusion under conditions of steady-state flow in unconfined coastal aquifers. A viscous flow model is used to verify the equation for the length of salt water intrusion. Figures are constructed to show the relationship between theoretical curves and experimental data. The experimental results are conclusive in proving the validity of this equation. The equation appears to be valid even when the Dupuit assumptions are no longer valid. It is conjectured that this equation may be rigorously valid in spite of the fact that it is derived on the basis of several simplifying assumptions. The theoretical profiles of the fresh water-salt water interface reproduce closely the observed profiles. It is observed that salt water moves toward the outlet along the zone of diffusion toward the outflow section. This observation confirms previous flow-net analysis.—Author's abstract

Conner, Donald C. *See* Collins, Donald F. 0933

0610 **Cook, Kenneth L.** Gravity studies in Utah: Am. Geophys. Union Trans., v. 46, no. 3, p. 569-573, illus., table, 1965.

The areas of published and unpublished gravity coverage of Utah and gravity surveys in progress are shown in a sketch map keyed to references. The work has been done by the University of Utah and the U.S. Geological Survey. The principal results to date have been to delineate many of the large Basin and Range fault blocks and obtain the order of magnitude and minimum total displacement along the bounding fault zones by estimating the thickness of the valley fill in the graben areas. Other important results are summarized briefly.—D.B.V.

0623 **Cordova, Robert M.** Hydrogeologic reconnaissance of part of the headwaters area of the Price River, Utah: Utah Geol. and Mineralog. Survey Water-Resources Bull. 4, 26 p., illus., tables, 1964.

This area of 33 sq mi is between Scofield Dam and Colton in the High Plateaus section of Utah. Five geological formations of Cretaceous and Tertiary age, distinguishable in the area, are described briefly, along with terrace and alluvial deposits, and indicated on a geologic sketch map. The faulted and jointed rocks are folded into a shallow syncline plunging northeastward. Some ground water issues from springs and seeps, and two deep wells penetrate aquifers in the Flagstaff Limestone (Tertiary) and the North Horn Formation (Cretaceous-Tertiary), the deepest being about 1,500 feet below the land surface. Most of the ground water in the area is suitable for municipal and industrial use. Logs of the two wells at Colton are presented.—G.D.C.

0521 **Corte, Arturo; Higashi, Akira.** Experimental research on desiccation cracks in soils: U.S. Army Materiel Command Cold Regions Research and Eng. Lab. Research Rept. 66, [76] p., illus., tables, 1964.

Desiccation crack experiments were made in Bloomington till from Lily Lake area, Ill., and soil from the Thule area, Greenland. Crack pattern depends more on material of bottom container and soil sample thickness than on temperature or humidity. Total crack length and number of cell sides decrease with increase in sample thickness. Stones serve as nucleating points from which cracks start and their shape, size, etc., affect initiation of cracks but not the geometry and mean area of cells. Habituation or the soil tendency to crack in the same pattern at different wetting and drying cycles is promoted by complete soaking of soil and by mixture of particles with soil.—M.C.

Cowper, N. W. *See* Oliver, T. A. 0900

Cox, Doak C. *See* Sunn, Franklin Y. K. 0577

0927 **Crawford, John M.** World-wide operations of "Vibroseis" system [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 49, no. 7, p. 1083, 1965.

0643 **Cummins, R. S., Jr.; Ingram, L. F.** Use of radioisotopes in sediment transport studies, *in* Federal Inter-Agency Sedimentation Conf., Jackson, Miss., 1963, Proc., Symposium 2—Sediment in streams: U.S. Dept. Agriculture Misc. Pub. 970, p. 578-585, illus., 1965.

The use of radioactive material for tracing sediments is a tool with limitations that under certain situations can provide worthwhile results. Quantitative measurements are difficult because of the nature of sediment movement and the tracer material itself. The inherent safety hazards prevent tests of long duration, but large areas can be studied in a relatively short time, and in spite of limitations, tracing techniques offer the only method for continuously tracing sediments in deep water without direct sampling.—G.D.C.

Damon, P. E. *See* Mauger, R. L. 0611

0674 **Darragh, P. J.; Sanders, J. V.** The origin of color in opal based on electron microscopy: Gems and Gemology, v. 11, no. 10, p. 291-298, illus., table, 1965.

All precious opals are formed from spherical particles of amorphous silica. In gem opal spheres are uniform in size, packed together in a very regular manner, and have regularly arranged spaces or voids between them. The structures are not visible with an optical microscope but can be seen easily when replicas of fracture surfaces are viewed in an electron microscope. Etching of fracture surfaces reveals the spheres and their uniformity. Variations in diffraction of light through the sphere and spaces produces the play of colors in the gem material. The size of the spheres can be predicted by assessment of the maximum wavelength that can be seen. The color is homogeneous where regularity of packing of spheres is maintained in the same orientation. The spheres have a central dot and concentric ring inside, which suggest

nucleus and growth ring and indicate growth in an undisturbed aqueous solution.—M.C.

0606 **Davies, J. C.; Pryslak, A. P.** (compilers) Lake of the Woods sheet, Districts of Kenora and Rainy River: Ontario Dept. Mines Prelim. Geol. Map P.281, scale 1 in to 2 mi, 1965.

0980 **Davis, Gregory A.; Holdaway, M. J.; Lipman, Peter W.; Romey, W. D.** Structure, metamorphism, and plutonism in the south-central Klamath Mountains, California: Geol. Soc. America Bull., v. 76, no. 8, p. 933–965, illus., tables, geol. map, 1965.

A central north-trending belt of eugeosynclinal metamorphic rocks is separated from slightly metamorphosed Paleozoic rocks on the east by a sheetlike body of ultramafic rock, and is flanked on the west by slightly metamorphosed Paleozoic and Triassic rocks. Late Jurassic (Nevadan) quartz diorites, trondhjemites, granodiorites, diorites, and gabbros intrude the older rocks as plutons ranging in size from 1 to 80 sq mi. Two orogenic phases have been recognized. One, in late Paleozoic time gave rise to recumbent folding, major thrusting, and greenschist- to amphibolite-facies metamorphism. A later deformation, which predates the plutonic rocks, produced upright south-trending folds and some lower- to middle-greenschist facies metamorphism.—J.P.A.

0489 **Davis, R. W.** Availability of ground water in the Mayfield quadrangle, Jackson Purchase region, Kentucky: U.S. Geol. Survey Hydrol. Inv. Atlas HA-164, scale 1:24,000, section, text, 1965.

The Eocene sand in the Mayfield quadrangle contains an abundance of good-quality ground water for present and future use; the formation is 200–400 feet thick and is completely saturated. A few wells obtain shallow perched water from gravel or alluvial deposits. Tables show the chemical analysis of the water and a section indicates the water-bearing character of the geologic formations.—M.C.M.

0932 **Deacon, Robert J.; Newton, Vernon C., Jr.** Review of coastal stratigraphy of Oregon and Washington with comments on 1965 activity [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 49, no. 7, p. 1083, 1965.

0972 **Deboo, Phili B.** Biostratigraphic correlation of the type Shubuta Member of the Yazoo Clay and Red Bluff Clay with their equivalents in southwestern Alabama: Alabama Geol. Survey Bull. 80, 84 p., illus., 1965.

Occurrence data were analyzed for ostracodes and planktonic and benthonic foraminifers, to establish a boundary between the Jacksonian and Vicksburgian stages (time-stratigraphic) in southeastern Mississippi and southwestern Alabama and to determine its relation to the Eocene–Oligocene boundary. The range data for each microfossil group were plotted for four continuously exposed sections in Alabama and one composite section in Mississippi (Yazoo Clay to Marianna Limestone); these form the basis of three biostratigraphic zones, *Floridina antiqua*, *Spondylus dumosus*, and *Lepidocyclina mantelli*. The Jacksonian–Vicksburgian boundary is placed at the base of the *S. dumosus* zone; the Eocene–Oligocene boundary lies within the zone. All important species (58 ostracodes and 165 foraminifers) are briefly described.—V.M.J.

Delabrio, R. N. *See* Chamberlain, J. A. 0528

delCampo, Alejandro. *See* Serafim, J. Laginha. 0700

Dewar, R. S. *See* Wahlberg, J. S. 0683

0493 **Díaz G., Teodoro; Navarro Galindo, Arsenio.** Litología y correlación estratigráfica del Paleozoico Superior en la región de Palomas, Chihuahua, Mexico: Assoc. Mexicana Geólogos Petroleros Bol., v. 16, nos. 5–6, p. 107–120, illus., 1964.

About 2,400 m of sedimentary strata has been measured for Sierra de Palomas, 750 m for Sierra de Los Chinos, and 800 m for Sierra de Santa Rita. The Palomas section is divided into nine lithologic units correlated with the Mississippian–Permian

sequence in nearby Big Hatchet Mountains, N. Mex. The Los Chinos section consists of dolomites of the Permian Wolfcamp and Leonard Series. The upper 600 m of the Santa Rita section consists of dolomites of Leonard and perhaps Word age; the lower 200 m is separated by a covered interval and its relation is not known. Considering lithology and location of the mountains within the sedimentary basin called the Pedregosa in Arizona and New Mexico, exploration drilling for petroleum is recommended in the asymmetric anticline and faulted flanks of Sierra de Los Chinos; this will also give valuable geologic data for the lower Paleozoic.—V.M.J.

Dietrich, Rudy J. *See* Mansur, Charles I. 0698

0681 **Doe, Bruce R.; Newell, Marcia F.** Isotopic composition of uranium in zircon: Am. Mineralogist, v. 50, nos. 5–6, p. 613–618, table, 1965.

Twenty analyses were made of the isotopic abundances of U-238, U-235, and U-234 in 13 selected zircon samples by mass spectrometry. Five samples were checked for U-238/U-234 by alpha spectrometry. . . . The range in U-235/U-234 is about 9 percent. Variations in U-235/U-234 cannot be correlated with age, grain size, percent discordance in the isotopic ages, type of discordance (positive or negative), uranium content, or radiation damage. The ratio, U-235/U-234, for two of four samples could not be reproduced within analytical uncertainties, suggesting lack of sample homogeneity or problems arising from chemical procedures. The range in U-235/U-234 is not large enough to account for discordant U-Pb ages in zircons by radioactive disequilibrium between U-238 and U-234. . .—Authors' abstract

Doerr, Arthur H. *See* Guernsey, J. Lee. 0551

Donaldson, J. Roger. *See* Hacquebard, Peter A. 0975

0542 **Dott, R. H., Jr.** Mesozoic–Cenozoic tectonic history of the southwestern Oregon coast in relation to Cordilleran orogenesis: Jour. Geophys. Research, v. 70, no. 18, p. 4687–4707, illus., tables, 1965.

The southwestern Oregon coast has been investigated in order to determine the interrelations of diastrophism and sedimentation in a complex eugeosynclinal area. The basic tectonic pattern, fundamental stratigraphic relationships, orogenic history of the area, the major thrust hypothesis, relationships to the Mesozoic of the California Coast Ranges, age of the coastal shear zones, and Cordilleran orogenesis in perspective are discussed.—D.B.V.

0931 **Douglas, Robert.** Upper Cretaceous planktonic Foraminifera from west side of Sacramento Valley [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 49, no. 7, p. 1083–1084, 1965.

0506 **Dow, Garnett McCormick.** Petrology and structure of North Haven Island and vicinity, Maine [abs.]: Dissert. Abs., v. 26, no. 1, p. 310–311, 1965.

Dreezen, V. H. *See* Reed, E. C. 0883

0584 **Duncan, John R., Jr.** The effects of water table and tide cycle on swash-backwash sediment distribution and beach profile development: Marine Geology, v. 2, no. 3, p. 186–197, illus., 1964.

Along a sand beach, when the tide is high and the beach water table low, swash deposition and erosion predominate, so that a thick sediment lens is formed on the shoreward side of the swash-backwash zone and a scoured area on the surf side. In contrast, a relatively high water table results in maximum backwash action, and the formation of the thick lenses near the surf boundary. Therefore, as sea level fluctuates with the tide, the zone of deposition correspondingly shifts and either increases or decreases the beach slope. As the tide rises previous swash deposits are redistributed, and above the highest swash-mark area a berm forms which displays an onlap-offlap series of laminae. This berm and its often cross-laminated structure result from flood-to-ebb tide sedimentation.—G.D.C.

Dunrud, C. R. *See* Osterwald, F. W. 0561

0562 **Dunrud, C. R.; Osterwald, F. W.** Seismic study of coal mine bumps, Carbon and Emery Counties, Utah: Soc. Mining Engineers Trans., v. 232, no. 2, p. 174–182, illus., 1965.

In 1962 the Geological Survey constructed a continuously recording seismic network to locate epicenters and record incidence of bumps in coal mines of the Sunnyside area, Utah. Daily records of tremors caused by bumps for 1 3/4 years show that a seasonal as well as a daily pattern exists for the number of bumps occurring in a given period. Maxima occur in May–June and November–December, with marked increases at 5 to 9 day intervals superimposed on the seasonal maxima. Largest bumps commonly occur during seasonal maxima when rate of occurrence decreases suddenly and amplitude of individual bumps increases. Knowledge of this pattern may lead to prediction of the general locations and periods of increased hazards from bumps but prediction of precise times and locations has not been and may never be possible.—M.C.

0613 **Duvall, W. I.; Stephenson, D. E.** Seismic energy available from rockbursts and underground explosions: Soc. Mining Engineers Trans., v. 232, no. 3, p. 235–240, illus., table, 1965.

The amount of energy released when a cylindrical or spherical underground cavity is suddenly enlarged can be calculated from the amount of work done by the applied stress field at some large distance from the cavity and the strain energy stored in the rock surrounding the cavity. The energy by which the work done by the stress field exceeds the increase in strain energy radiates outward as seismic energy, and can be calculated from the volume of rock removed or relieved of stress. Larger rockbursts involving 10^4 to 10^8 cubic feet of rock correspond to perceptible earthquakes. The amount of seismic energy from the stress field is relatively small compared to that from detonation of an explosion except for explosions at large depths.—M.C.

Dyer, Kenneth L. *See* Schiff, Leonard. 0572

0858 **Eames, F. E.; Blow, W. H.** The stratigraphical position of the Vista Bella Limestone, Trinidad [with French abs.]: Rev. Micropaléontologie, v. 8, no. 1, p. 11–14, illus., 1965.

Comparisons are made of limestones at Farallon Rock and the Vista Bella Limestone near San Fernando in Trinidad, both of which have been considered as essentially the same age, late Eocene. The faunal content of the Farallon Rock limestones include the genera *Polylepidina, Helicostegina, Tremastegina, Asterocyclina,* and *Discocyclina,* which occur naturally only in the Eocene, so the rock samples are judged to be late Eocene in age. The Vista Bella Limestone contains many of these fossils but also is characterized by another group, including large microspheric *Lepidocyclina* and *Pliolepidina,* which are believed to be early Miocene (Aquitanian) age and suggest the same age for the Vista Bella.—M.C.

0930 **Echols, Ronald J.** Foraminiferal trends in South Sandwich trench [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 49, no. 7, p. 1084, 1965.

0860 **Eicher, Don L.** Foraminifera and biostratigraphy of the Graneros Shale: Jour. Paleontology, v. 39, no. 5, p. 875–909, illus., 1965.

Descriptions of 23 arenaceous and 11 calcareous species of Foraminifera, occurring in the Graneros Shale and its equivalents in the western interior, are given. Arenaceous specimens are most common and widespread, planktonic specimens are locally common, and calcareous benthonic specimens are extremely rare. The provenance of Graneros foraminifers is both boreal and Gulf Coastal. Planktonic specimens from the upper portion of the underlying Mowry Shale indicate that the boreal and Gulf Coastal seas actually connected in latest Mowry time. Both arenaceous and calcareous planktonic foraminifers suggest that the entire Graneros is Cenomanian in age. Planktonic specimens from the uppermost Mowry suggest

a Cenomanian age also. Five new species and one new subspecies are described.—from author's abstract

Ellison, Robert L. *See* Christensen, John H. J. 0723

Ellison, Robert L. *See* Meintzer, Robert. 0725

0537 **Elvir A., Reniery.** Reconocimientos geológicos en Tamazunchale, S.L.P., Zimapán, Tlanchinol y Molango, Hgo.: Geología y Metalurgía, v. 2, no. 12, p. 5–17, illus., tables, 1965.

Preliminary exploration for tin, iron, and manganese in Hidalgo and San Luis Potosí, Mexico, is outlined briefly. The El Pilón iron deposit in the Zimapán area, Hidalgo, is hematite and magnetite in fissure veins in Cretaceous limestone, with reserves of about 5,048 metric tons, 60 percent iron. Tin ore samples from the Zimapán area contain 0.015–2.9 percent tin; the small Tehzu deposit, stockworks in rhyolite, 0.27 percent tin, is not considered commercial. No tin was found in the Tamazunchale area. Large deposits of low-grade (15–20 percent), hard-to-concentrate manganese ore crop out in the Tlanchinol area, northeastern Hidalgo, in a zone between Chipoco and Chachala, and also southwest of Molango; Upper Jurassic slates and schists contain pyrolusite in layers and lenses. Further exploration of the Upper Jurassic between Tlanchinol and Tepehuacán de Guerrero is recommended.—V.M.J.

0897 **Emery, K. O.** Characteristics of continental shelves and slopes: Am. Assoc. Petroleum Geologists Bull., v. 49, no. 9, p. 1379–1384, illus., 1965.

More than a single origin of continental shelves and slopes is involved for different areas or for different times. Data on structure, composition, and topography provide clues for interpretation of geological history and thus of origin, but such clues are presently so incomplete that interpretations are uncertain.

0646 **Emmett, William W.; Leopold, Luna B.** Downstream pattern of riverbed scour and fill, *in* Federal Inter-Agency Sedimentation Conf., Jackson, Miss., 1963, Proc., Symposium 2—Sediment in streams: U.S. Dept. Agriculture Misc. Pub. 970, p. 399–409, illus., 1965.

This paper presents recent observations of channel scour and fill over relatively long reaches of three streams in the western United States: the ephemeral Arroyo de los Frijoles near Santa Fe, N. Mex., the perennial Rio Grande del Ranchos near Taos, N. Mex., and Popo Agie River near Hudson, Wyo. Over a period of five years the depths, widths, and lengths of scour were plotted in flood and low-flow. No meaningful relation could be established between channel properties and the magnitude of scour in all types of sections. Scour is associated with dilation of the grain bed, but individual particles may move intermittently and more slowly than water, so that the whole volume of material is shifted downstream only a limited distance.—G.D.C.

0890 **Ernst, W. G.** Mineral paragenesis in Franciscan metamorphic rocks, Panoche Pass, California: Geol. Soc. America Bull., v. 76, no. 8, p. 879–914, illus., tables, geol. map, 1965.

Metabasalts, metagraywackes and metacherts show systematic mineral paragenesis. Conversion of greenstone to blue schists is characterized by albite+actinolite+chlorite to crossite+lawsonite, with calcite going to aragonite. Metacherts containing minor albite+calcite convert to aegirine+riebeckite+aragonite, and metagraywackes containing minor lawsonite and carbonate go to jadeitic pyroxene+abundant lawsonite+glaucophane+aragonite. A jadeitic pyroxene+lawsonite isograd is defined for metagraywacke assemblages, but more extreme conditions are involved than required to convert greenstones to blue schists. Overall metamorphic conditions postulated are 200–300°C and lithostatic pressures of 7–8 kb; the tectonic model requires rapid sedimentation and downbuckling followed by rapid uplift and erosion.—J.J.H.

Erwin, Robert B. *See* Chen, Ping-fan. 0627

Espey, William H., Jr. *See* Masch, Frank D. 0653

0963 **Evans, B. W.** Application of a reaction-rate method to the breakdown equilibria of muscovite and muscovite plus quartz: Am. Jour. Sci., v. 263, no. 8, p. 647-667, illus., tables, 1965.

The equilibrium conditions for the reversible reactions in which muscovite decomposes to K-feldspar, corundum, and water, and in which muscovite and quartz decompose to K-feldspar, and andalusite, sillimanite, or kyanite, and water, were found by a method that determines the rate of reaction as a function of temperature at fixed pressure.—D.L.D.

Evans, J. R. *See* Hollister, V. F. 0886

Ewing, John. *See* Ewing, Maurice. 0670

0670 **Ewing, Maurice; Ludwig, William J.; Ewing, John.** Oceanic structural history of the Bering Sea: Jour. Geophys. Research, v. 70, no. 18, p. 4593-4600, illus., 1965.

The results of continuous sub-bottom reflection measurements in the Bering Sea are reported. The basin sediments are markedly undisturbed, suggesting that the tectonic effects of the Aleutian Ridge are restricted to a very narrow zone, probably too narrow to imply moving of the ocean crust under the Aleutian arc by convection. The results are all compatible with the hypothesis that the south wall of the Aleutian trench was formerly a normal ocean floor that has tilted down either in response to the elevation of the Aleutian Ridge or as an accompaniment to an overall subsidence of the ridge-basin system.—D.B.V.

0666 **Falconer, G.; Ives, J. D.; Løken, O. H.; Andrews, J. T.** Major end moraines in eastern and central Arctic Canada [with French abstract]: Canada Dept. Mines and Tech. Surveys Geog. Br. Geog. Bull., v. 7, no. 2, p. 137-153, illus., table, 1965.

A study is reported of a system of end moraines over 2,000 km long in Northwest Territories. The system parallels the northeast coast of Baffin Island, extends down the west coast of Melville Peninsula, and crosses northern Keewatin; it marks the border of the late-Wisconsin ice sheet centered over Foxe Basin and Hudson Bay between 8,000 and 9,000 years ago. From studies of moraines and comparisons of the C-14 ages of shells, previously obtained, it is concluded that this series should be assigned the name, Cockburn Moraine System, and the term, Cockburn Phase, be used to represent an important glacial phase in the late-Wisconsin history of Canada. Moraines in southern Canada, namely, the Lake Athabasca-Cree Lake moraine and morainal areas in northwestern Ontario, are also included in the Cockburn Phase.—M.C.

0507 **Fan, Pow-foong.** Recent silts in the Santa Clara River drainage basin, California—A mineralogical investigation of their origin and evolution [abs.]: Dissert. Abs., v. 26, no. 1, p. 311-312, 1965.

Farvolden, R. N. *See* Bredehoeft, John D. 0568

0554 **Felix, Charles J.** Neogene *Tasmanites* and leiospheres from southern Louisiana, U.S.A.: Palaeontology, v. 8, pt. 1, p. 16-26, illus., 1965.

These Tertiary microfossils are found in core samples from oil wells in La Fourche, St. Mary, and Terrebonne Parishes, and occur in Neogene shales in the Gulf Coast area of the State. Seven species of *Tasmanites*, one species of *Tytthodiscus*, and two species of *Leiosphaeridia* are described from the samples; all except the *Tytthodiscus* are new.—M.C.

0929 **Ferris, Craig.** Gravity and compaction anticlines in highly explored areas [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 49, no. 7, p. 1084, 1965.

Fiedler, G. H. *See* Garling, M. E. 0856

0732 **Finlayson, C. Pratt.** Geologic map of the Maynardville quadrangle, Tennessee: Tennessee Div. Geology Geol. Map GM 145-SE, scale 1:24,000, sections, separate text, 1964.

The text, "Mineral resources summary of the Maynardville quadrangle, Tennessee," describes the limestone, iron ore, and barite in the area. Abundant reserves of limestone and dolomite in rocks of the Knox Group and the Chickamauga Limestone are well suited for ordinary crushed-stone uses. Iron ore in the form of bedded hematite, being mined from the Rockwood Formation in the central part of the quadrangle, ranges from 1 to 3 feet in thickness and is confined to an area approximately 4 miles long. Barite occurs within the Chickamauga Limestone with a few thin veins extending into the underlying Mascot Dolomite. Potential resources are lead and zinc, shale and chert.—M.C.M.

Fisher, W. L. *See* Shelby, C. A. 0531

0651 **Flaxman, Elliott M.** Some aspects of fluvial morphology influencing investigations of channel stability, *in* Federal Inter-Agency Sedimentation Conf., Jackson, Miss., 1963, Proc., Symposium 1—Land erosion and control: U.S. Dept. Agriculture Misc. Pub. 970, p. 136–143, illus., table, 1965.

A method for differentiating between channel, fan, or flood-plain deposits in alluvial valleys involves a determination of the rate of particle size increase and plotting this value in relation to the size. Correct interpretation must consider postdepositional influences. Fluvial morphology of three western valleys—Skokomish River, Wash., Adobe Creek, Calif., and Green River, Wash.—demonstrate the relation between environments of deposition and stratigraphy of alluvial valleys.—G.D.C.

0957 **Fleming, N. C.** Form and relation to present sea level of Pleistocene marine erosion features: Jour. Geology, v. 73, no. 5, p. 799–811, illus., 1965.

Pleistocene marine erosion features and Pleistocene sea levels were the product of many variable factors that must be considered in correlation of erosion features and determination of former sea levels. The most important and most readily determined variables that affect terrace formation are wind fetch and land slope. A marine terrace may be modified by weathering, passage of sea level, or earth movements, and absolute altitude of a terrace is not a sure indication of its chronological position. Sea level derivations should be corrected for variabilities in lithology, cave formation, tidal range, and solution, as well as fetch and land slope.—E.T.R.

0573 **Fowler, Lloyd C.; Valantine, Vernon E.** The coordinated use of ground water basins and surface water delivery facilities [with French abstract]: Internat. Assoc. Sci. Hydrology Pub. 64, p. 376–383, illus., 1964.

Local water resources can be increased by coordinated use of ground-water basins and surface water delivery facilities. Where pumping has left more available storage space in ground-water reservoirs than that needed for storage of local runoff, the space can be used to store and distribute water imported from other areas and, depending on the storage capacity and aquifer transmissibility, to regulate rates of water deliveries to seasonal, daily, and even hourly peak demands.—M.C.

0477 **Friedman, Gerald M.** Occurrence of talc as a clay mineral in sedimentary rocks: Nature, v. 207, no. 4994, p. 283–284, table, 1965.

Talc has recently been found to be widespread in limestones ranging in age from Devonian through Recent, almost invariably accompanied by chlorite and sometimes by other clay minerals also. An authigenic origin is proposed.—D.B.V.

0729 **Fudali, R. F.** Oxygen fugacities of basaltic and andesitic magmas: Geochim. et Cosmochim. Acta, v. 29, no. 9, p. 1063–1075, illus., tables, 1965.

Experimentally determined oxygen fugacities in equilibrium with the original ferric iron ratios of 9 basalts and andesites range from $10^{-8.5}$ to $10^{-6.4}$ atm at 1,200°C. The O_2 fugacity tends to increase with increasing acidity. Theoretical calculations of equilibrium of these oxygen fugacities give results reasonably close to actual values for runs in the 10^{-6}–10^{-8} range, but are in substantial error for runs made in air atmosphere. It is deduced that if oxygen fugacity is important in controlling the differentiation trend of rocks of the Cascade province, the mechanism must operate in the range 10^{-9}–$10^{-6.5}$ atm.—D.B.V.

Furnish, W. M. *See* Nassichuk, W. W. 0590

Furumoto, Augustine S. *See* Adams, William Mansfield. 0847

0848 **Furumoto, Augustine S.; Woollard, George P.** Seismic refraction studies of the crustal structure of the Hawaiian archipelago: Pacific Sci., v. 19, no. 3, p. 315-319, illus., 1965.

The Hawaiian Islands area of the Pacific is characterized by three crustal and geomorphic provinces, namely, the Hawaiian Arch, the Hawaiian Deep, and the Hawaiian Ridge. The crust in this area has four distinct layers. Average depth to the mantle is 10 km and mantle velocity equals 7.97-9.68 kmps. In the Hawaiian Ridge just north of Maui at the proposed Mohole site, a velocity comparable to that of the Moho is found at a depth of 5.8 km and magnetic data suggest that the shallow depth is related to an intrusive. In the area of the Hawaiian Deep, depth of the mantle is about 13 km and the origin of the Deep is thought to be related to subsidence under the Ridge.—M.C.

0868 **Furumoto, Augustine S.** A gravity survey of the island of Kahoolawe, Hawaii: Pacific Sci., v. 19, no. 3, p. 349, illus., 1965.

The survey was conducted in 1964 using a Worden gravity meter with slow drift. Fifteen observations on points covering the entire island were made in 3.5 hours. Field data were reduced by applying Bouguer corrections with the assumption that the surface density was 2.3 g/cm^3 and the reduced data were plotted on a map with 5-mgal intervals. A region of high positive anomaly occurs on the east side of the island and agrees with the surface geology, which shows a center of former volcanic activity at that point.—M.C.

0876 **Furumoto, Augustine S.; Thompson, Noel J.; Woollard, George P.** The structure of Koolau Volcano from seismic refraction studies: Pacific Sci., v. 19, no. 3, p. 306-314, illus., 1965.

Seismic refraction data, confirming earlier gravity and magnetic surveys, gave a composite west-east structure section showing: a northwest rift zone with three distinct layers and noteworthy for a fourth high velocity layer of 7.6-7.7 kmps starting at a 6 km depth and probably resulting from differentiation in the magma chamber; the caldera, underlain by a 2 km layer with a velocity of 4.63 kmps and then by the volcanic plug; and the southern flank where the submerged portion measured shows four layers, the top, down to a 2-km depth, with a velocity of 3.0 kmps, the second, 2-10 km, 4.97 kmps, the third, 10-21 km, 6.75 kmps, and the fourth, below 21 km, 8.8 kmps. The plug apparently underlies only the caldera and forms a sharp transition border with the southern flank and a similar one, to a depth of 6 km, with the rift zone, which should be examined further to see if a still higher velocity layer does not occur below the known fourth layer.—M.C.

0856 **Garling, M. E.; Molenaar, Dee; Bailey, E. G.; VanDenburgh, A. S.; Fiedler, G. H.** Water resources and geology of the Kitsap Peninsula and certain adjacent islands: Washington Div. Water Resources Water Supply Bull. 18, 309 p., illus., tables, geol. map, 1965.

The area consists largely of rolling hills, remnants of a glacial drift plain. Rocks range in age from Tertiary volcanics and sediments through Quaternary unconsolidated sand, gravel, silt, and clay. Ground-water aquifers are limited primarily to Pleistocene deposits, notably the Salmon Springs (?) drift. Ground-water tables under peninsula and islands have the surrounding marine waters as

a base level, but depth to water in most wells is within 100 feet of the surface. Water supply far exceeds its use and perennial yield may range from 1–3 acre-feet per acre per year; quality is also good. Future use and excess withdrawal may cause salt-water contamination, but available surface water supplies may offset this factor.—M.C.

Garrels, R. M. *See* Mackenzie, F. T. 0971

0983 **Gates, Joseph S.** Reevaluation of the ground-water resources of Tooele Valley, Utah: Utah State Engineer Tech. Pub. 12, 68 p., illus., tables, 1965.

This valley, 30 miles southwest of Salt Lake City, is a structural depression bordered by mountains composed largely of Paleozoic marine deposits. Alluvial, colluvial, lacustrine, and possible volcanic deposits of Tertiary and Quaternary age fill the valley, at one place probably as thick as 7,100 feet. Five faults in the valley were redefined. Almost all of the 1,300 wells in the valley tap artesian aquifers; discharge from wells has more than tripled since 1940, whereas from springs it has decreased about one-fourth. Future development of ground water in Tooele Valley will reduce losses by evapotranspiration and subsurface flow to Great Salt Lake, but concurrently result in lower water levels and decreased springs, and possible migration of water of poorer quality into good areas.—G.D.C.

0882 **Gazin, C. Lewis.** An endocranial cast of the Bridger middle Eocene primate, *Smilodectes gracilis*: Smithsonian Misc. Colln., v. 149, no. 4 (Smithsonian Inst. Pub. 4616), 14 p., illus., 1965.

Among materials collected in 1959 from the Bridger Basin of southwest Wyoming is the cranial portion of a skull belonging to the small notharctid primate, *Smilodectes gracilis*. Not finding the rostral portion, the undistorted bone was destroyed to reveal a natural cast of the endocranium, sometimes referred to as a "fossil brain". The cast is short and broad, but shows a remarkable development for the cerebral cortex or neopallium, relatively greater than in any other middle Eocene mammal for which such information is available. The only portion missing is the anterior segment representing the olfactory lobes. The details are described for the various portions of the cast, and comparison is made with *Notharctus* and a later Eocene *Adapis* endocranial cast.—G.D.C.

Geddes, Wilburt. *See* Zietz, Isidore. 0949

0522 **Gibbs, Ronald J.** Error due to segregation in quantitative clay mineral X-ray diffraction mounting techniques: Am. Mineralogist, v. 50, nos. 5–6, p. 741–751, illus., tables, 1965.

Experimental study of seven common mounting techniques for quantitative analysis of clays by X-ray diffraction showed an acceptable precision or reproducibility—about ±10 percent—for all techniques. Accuracy, or closeness to "true" value, however, varied as much as 250 percent in the four techniques involving particle settling in aqueous solutions. Use of these techniques resulted in a surface segregation of montmorillonite. . . . The four techniques not acceptable . . . include: centrifuge-on-glass slide and centrifuge-on-ceramic tile, pipette- or dropper-on-glass slide, and beaker-on-glass techniques. . . . Acceptable are: smear-on-glass slide, suction-ceramic tile and powder press techniques.—Author's abstract

0508 **Gilbert, Murray Charles.** Synthesis and stability relations of the hornblende, ferropargasite [abs.]: Dissert. Abs., v. 26, no. 1, p. 312–313, 1965.

Giletti, B. J. *See* Mauger, R. L. 0611

0509 **Glenn, Jerry Lee.** Late Quaternary sedimentation and geologic history of the north Willamette Valley, Oregon [abs.]: Dissert. Abs., v. 26, no. 1, p. 313, 1965.

0718 **Goldstein, J. I.; Ogilvie, R. E.** The growth of the Widmanstätten pattern in metallic meteorites: Geochim. et Cosmochim. Acta, v. 29, no. 8, p. 893–920, illus., tables, 1965.

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The effects of pressure, temperature, and time on the formation of the Widmanstätten pattern in metallic meteorites have been established. A growth analysis is made that accounts for the change of D with Ni concentration; the change of D and the Fe–Ni phase diagram with pressure; the average meteorite composition; the radius of the parent body and pressure within it; the degree of undercooling before precipitation occurred; and the distance between precipitates. Excellent agreement between measured and calculated taenite composition gradients was found for low pressure (<12 kb) models. The formation of plessite, development of two-phase structures in ataxites, and decrease in Ni concentration in kamacite near the α/γ boundary are explained in terms of low pressure model.—D.B.V.

Goodwin, James C. *See* Sanborn, Albert F. 0894

0630 **Gottschalk, L. C.** Keynote address, *in* Federal Inter-Agency Sedimentation Conf., Jackson, Miss., 1963, Proc.—Opening session: U.S. Dept. Agriculture Misc. Pub. 970, p. 5–8, 1965.

With the advent of Man, the surface of the land has undergone a progressive change, resulting in greater erosion, more frequent and higher floods, more and more sediment. Geologists were among the first to be concerned about sedimentation, stemming from a need to understand genesis and formation of sedimentary rocks; the practical solution of sediment problems in many fields require skills in different sciences in addition to geology. As a new field of specialization, important and gratifying progress is being made in the science of sedimentation, and the Federal Inter-Agency Subcommittee on Sedimentation has contributed effectively to its rapid advancement.—G.D.C.

Gould, Mitchell L. *See* Willets, David B. 0565

0628 **Green, John C.** Stratigraphy and structure of the Boundary Mountain anticlinorium in the Errol quadrangle, New Hampshire–Maine: Geol. Soc. America Spec. Paper 77, 78 p., illus., tables, geol. map, 1964.

The Errol quadrangle is underlain by about 27,000 feet of metamorphic rocks, a part of the Boundary Mountain anticlinorium. About 22,000 feet are probably Cambrian and Ordovician, overlain unconformably in the northwest by unnamed Siluro–Devonian rocks. Intrusive bodies are a batholith of hornblende-biotite granodiorite (Taconic or Acadian) and stocks of biotite-muscovite adamellite (Acadian). The pre-Silurian strata are divided into the Cambro-Ordovician(?) Azicohos, the Ordovician(?) Albee, and the Ordovician(?) Dixville Formations; they are correlated with formations of northwestern New Hampshire, Vermont, and Eastern Townships of Quebec. The Diamond Peaks anticline, believed to plunge south or southwest, dominates the eartern part of the area. Broad folding during the Taconic is inferred, although the major orogeny was Acadian.—V.M.J.

Greenwood, H. J. *See* Orville, P. M. 0964

0722 **Gregor, Bryan.** Boron and oceanic evolution [discussion of paper by R. C. Reynolds, Jr., 1965]: Geochim. et Cosmochim. Acta, v. 29, no. 8, p. 1007–1008, 1965.

It is argued that Reynolds' data (Geochim. et Cosmochim. Acta, v. 29, no. 1, p. 1–16, 1965) can be used to support the hypothesis of an unchanging ocean, maintained by endo- and exogeneous geochemical cycles throughout geologic time.—D.B.V.

0857 **Groh, E. A.** Belknap Crater–Yapoah Crater–Collier Cone area field trip—Geologic summary, *in* State of Oregon lunar geological field conf., 1965, Guidebook: Oregon Dept. Geology and Mineral Industries Bull. 57, p. 29–38, illus., geol. maps, 1965.

Northwest of Bend predominantly Quaternary basalt erupted from various vents at the foot of the Cascade Range; from the range crest a panorama of lava fields and peaks can be seen. The Three Sisters, of which North Sister is the oldest volcano, and Mt. Washington to the north are basaltic shields on a pre-Pliocene

volcanic basement, and are topped by pyroclastics and some later flows. All have been deeply eroded by glaciers. Obsidian Cliffs, a large flow of glassy dacite, lies on the west flank of Middle Sister. Between North Sister and Mt. Washington is the basaltic shield of Belknap Crater with cinder cones about its flanks and basal extrusions of pahoehoe. Yapoah Crater and Collier Cone are the most recent eruptive centers and are characterized by thick, coarse aa flows.—G.D.C.

Guber, A. L. *See* Williams, E. G. 0704

0551 **Guernsey, J. Lee; Doerr, Arthur H.** Physical geography: Woodbury, N. Y., Barron's Educational Series, Inc., 216 p., illus., 1964.

This elementary textbook is designed to provide an operational framework for understanding of our physical environment for student and lay reader alike, to provide an appreciation of landforms in relation to scenic beauty and an explanation of the processes in evidence. Study questions and selected references are included in each chapter, along with simple illustrations. The appendix includes final examinations and a glossary.—G.D.C.

0540 **Guier, W. H.; Newton, R. R.** The Earth's gravity field as deduced from the Doppler tracking of five satellites: Jour. Geophys. Research, v. 70, no. 18, p. 4613–4626, illus., tables, 1965.

Gravity harmonics available at present do not have the same distribution as those of the topography; they are consistent with, but do not prove, random density variations that begin near the top of the mantle and continue down to an undetermined depth.—D.B.V.

Gunning, H. C. *See* Muller, J. E. 0712

0517 **Gupta, Pradip Kumar Sen.** The orientation of aliphatic amine cations on vermiculite [abs.]: Dissert. Abs., v. 26, no. 1, p. 317, 1965.

0592 **Gutschick, R. C.** *Pterotocrinus* from the Kinkaid Limestone (Chester, Mississippian) of Illinois and Kentucky: Jour. Paleontology, v. 39, no. 4, p. 636–646, illus., 1965.

Two zones in the Cave Hill member contain the aberrant crinoid *Pterotocrinus* Lyon and Casseday, with *P. edestus* n. sp., *P. tridecibrachiatus* n. sp., and *P. wahlessi* n. sp. in the lower and *P. pegasus* n. sp. in the upper. More than 2,000 wing plate and two complete calyces show that in contrast to the usual 20 biserial arms of early Chester species, the Kinkaid species have 30 biserial arms and a modified brachial plate arrangement, necessitating emendation of the genus and elucidating its phylogeny within the Chester.—R.E.G.

0961 **Haas, Otto.** Recent literature on Mesozoic ammonites, Pt. 6: Jour. Paleontology, v. 39, no. 5, p. 960–973, 1965.

A review is given of the recent literature on Mesozoic ammonites, dealing separately with papers of general scope, and with those on Triassic, Jurassic, and Cretaceous ammonites, respectively.—J.F.M.

0928 **Hackel, Otto.** Field trip orientation, southeastern San Joaquin Valley, Kern River to Grapevine Canyon [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 49, no. 7, p. 1084, 1965.

0975 **Hacquebard, Peter A.; Cameron, Alexander R.; Donaldson, J. Roger.** A depositional study of the Harbour seam, Sydney coalfield, Nova Scotia [English version]: Canada Geol. Survey Paper 65-15, 31 p., illus., 1965; originally published in German, 1964.

This paper was originally published in the symposiun on "Paläobotanische, kohlenpetrographische und geochemische Beiträge zur Stratigraphie und Kohlengenese", which was compiled in honour of Prof. Robert Potonié of Krefeld,

Germany. It was printed in vol. 12 of Fortschr. Geologie Rheinland u. Westfalen, p. 331–356, 1964.—G.D.C.

0640 **Hadley, R. F.** Characteristics of sediment deposits above channel structures in Polacca Wash, Ariz., *in* Federal Inter-Agency Sedimentation Conf., Jackson, Miss., 1963, Proc., Symposium 4—Sedimentation in reservoirs: U.S. Dept. Agriculture Misc. Pub. 970, p. 806–810, illus., tables, 1965.

Deposition caused by the construction of dams on Polacca and Wepo Washes since 1945 is estimated at 7,500 acre-feet. Of the total sediment deposited behind the structure approximately 8 percent is located above the spillway level, and aggradation was observed some distance above the anticipated influence of the dams. Longitudinal profiles surveyed above each dam on Polacca Wash showed present channel gradients of 0.0005–0.0037 ft/ft, which prior to dam construction had been 0.0040–0.0058 ft/ft. The extent of this deposition may be affected by valley width, channel slope, particle size of available material, and influence of riparian vegetation. The importance of each of these factors has yet to be determined.—G.D.C.

0664 **Hall, Francis R.** Calculated chemical composition of some sulfate-bearing waters [with French abstract]: Internat. Assoc. Sci. Hydrology Pub. 64, p. 7–15, illus., tables, 1964.

Calculation of chemical composition of water in contact with calcium carbonate and calcium sulfate can be of value in the study of ground water in limestone and gypsum aquifers. It can serve as a standard of comparison for actual data in tracing changes in chemical content from the recharge area down into the basin or for verifying inferences about the lithology of an aquifer. It may also be used to determine whether a particular ground water is still able to dissolve more limestone or gypsum around a dam foundation or to determine what further chemical changes may occur during intrusion of saline water. The considerable work already done on the hydrous Ca–C–O system has been widely applied to ground water in limestone aquifers.—M.C.

0903 **Hallam, A.** Observations of marine Lower Jurassic stratigraphy of North America, with special reference to United States: Am. Assoc. Petroleum Geologists Bull., v. 49, no. 9, p. 1485–1501, illus., tables, 1965.

Recent work on the stratigraphy of Lower Jurassic sedimentary rocks in Nevada, Oregon, and California is reviewed, and certain ammonite identifications amended. The zonal succession in the western United States is compared with that in Canada and Mexico, and the invertebrate fauna compared with the European. It is concluded that the American fauna shows strong European affinities, with Mediterranean elements present. Indigenous forms are more common among the pelecypods than the ammonites, though still subsidiary. The stratigraphic review reveals several widespread horizons in North America, in the Sinemurian and Toarcian, and a major stratigraphic gap in the Pliensbachian.—Author's abstract

0510 **Hand, Bryce Moyer.** Hydrodynamics of beach and dune sedimentation [abs.]: Dissert. Abs., v. 26, no. 1, p. 313–314, 1965.

Hansen, Dan E. *See* Kume, Jack. 0884

0589 **Hansman, R. H.** *Brachycycloceras*? from the Pennsylvanian of Texas: Jour. Paleontology, v. 39, no. 4, p. 729–730, 1965.

The nautiloid cephalopod *Brachycycloceras? spectrum* n. sp. is described from the Finis Shale, near Jacksboro.—R.E.G.

Hare, C. E. *See* Heck, H. T. 0695

Harris, F. R. *See* Pye, E. G. 0486

Harris, F. R. *See* Pye, E. G. 0533

0989 **Harris, Rae L., Jr.** . A water tower apparatus to improve zircon separation technique: Geol. Soc. America Bull., v. 76, no. 8, p. 971–974, illus., tables, 1965.

An apparatus through which a rising column of water is directed has been developed to separate heavy minerals. Tests in the recovery of zircons show that the method cuts costs and time of simple heavy liquid treatment significantly. Statistical checks of results indicate that length–width ratios and numbers of recovered zircons compare favorably with standard bromoform procedures.—Author's abstract

0482 **Harrison, Jack E.; Jobin, Daniel A.** Geologic map of the Packsaddle Mtn. quadrangle, Idaho: U.S. Geol. Survey Geol. Quad. Map GQ–375, scale 1:62,500, sections, separate text, 1965.

Precambrian and Cambrian sedimentary rocks exposed in the Packsaddle Mountain quadrangle are shattered by faults, intruded by sills, dikes and small plutons, and covered in low areas by glacial debris. Sedimentary and metasedimentary rocks, surficial deposits, igneous rocks, and the complex fault system of the area are described. Veins of base- and precious-metal sulfides have been mined.—M.C.M.

0555 **Haught, Oscar L.** Oil and gas report on Barbour and Upshur Counties, West Virginia: West Virginia Geol. and Econ. Survey Bull. 31, 15 p., illus., table, 1965.

The area is characterized by rugged topography and shallow folding in the exposed formations, which are almost all Pennsylvanian in age and contain many good producing coal beds. Most of the oil and gas found comes from the Pocono beds (Mississippian) below the Greenbrier Formation, and other oil "sand" zones. Numerous producing as well as dry wells have been drilled in both counties. Natural gas production has been important since about 1920 but no major oil production has been developed. From the Pittsburgh and Redstone seams, 2,379,000 tons of coal were produced in 1963 from Barbour County, and 751,000 tons from Upshur County.—M.C.

0625 **Hawaii Div. Water and Land Devel.** Summary of drilling log and pumping test for Makena Well 68, Makena, Maui, Hawaii: Hawaii Div. Water and Land Devel. Circ. C28, 13 p., illus., tables, 1964.

This well lies on the southwestern slopes of East Maui within the Makawao district, three-fourths of a mile inland from the coast at an elevation of 352 feet, its depth extending 30 feet below sea level. The well penetrates permeable lava flows of the Hana volcanic series and possibly the underlying less permeable Kula volcanic series which is separated from the Hana series by an erosional unconformity. Because the climate is dry and the lava flows highly permeable, the development of a potable basal water source is not very favorable. The well is sensitive to changes in chlorides under pumping conditions.—G.D.C.

Hawks, Paul H. *See* McHenry, J. Roger. 0641

0673 **Heald, Milton T.** Lithification of sandstones in West Virginia: West Virginia Geol. and Econ. Survey Bull. 30, 28 p., illus., table, 1965.

The sandstones of this State have undergone many different diagenetic processes. Most of the Tuscarora Sandstone is cemented uniformly with quartz but some beds show conspicuous differential cementation, which was controlled by distribution of clay, gas pockets, and fracture zones. The Oriskany Sandstone is cemented with quartz and calcite, the latter occurring mostly where the original beds were high in calcite. Porous zones result from incomplete cementation rather than carbonate leaching, although hydrocarbons may have prevented cementation in some places. In the Carboniferous sandstones, quartz is the chief cement with minor amounts of calcite. Feldspar commonly is replaced by calcite or kaolinite and occasional chlorite coating on grains inhibits precipitation of cement. Pressure solution occurred along stylolite seams and along grain contacts in some of the formations. Porosity was also lost by compaction of weak grains.—M.C.

0695 **Heck, H. T.; Hare, C. E.; Hoskins, H. A.** Appalachian connate water: West Virginia Geol. and Econ. Survey Bull. 28, 42 p., illus., tables, 1964.

Petroleum brines were formerly considered as "fossil seawater" trapped in sediments during deposition. However, not all water in sedimentary rocks is connate nor is all salt from brines necessarily derived from seawater. Reactions occurring in nature probably could and do change the chemical content of present day river water so that it produces little or no change in the percentage of each chemical in ocean salt. The percentage of any one chemical in ocean salt does not appear to have increased or decreased materially with respect to any other chemical since Silurian time or earlier. This seems to be confirmed by comprehensive study of salts in brines of Appalachian connate water from Paleozoic rocks in West Virginia, Pennsylvania, and Ohio.—M.C.

0977 **Heintz, Louis O.; Vernon, James W.** Geology of south-central Tejon oil field [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 49, no. 7, p. 1084–1085, 1965.

0498 **Helander, Donald Peter.** The effect of pore configuration, pressure, and temperature on rock resistivity [abs.]: Dissert. Abs., v. 26, no. 1, p. 235, 1965.

Henriksen, Niels. *See* Bondesen, Erling. 0981

0559 **Hepworth, Richard C.** Heaving in the subgrade of highways constructed on the Mancos Shale: Soc. Mining Engineers Trans., v. 232, no. 2, p. 124–131, illus., tables, 1965.

Main factors in the heaving mechanism on roads built on the Mancos Shale in east-central Utah are the presence of certain salts, the absorption of moisture, and the physical properties of the subgrade materials, the latter two being most important.—M.C.

0575 **Hicks, Steacy D.; Shofnos, William.** Yearly sea level variations for the United States: Am. Soc. Civil Engineers Proc., v. 91, paper 4468, Jour. Hydraulics Div., no. HY 5, pt. 1, p. 23–32, illus., tables, 1965.

With increasing time, continuous sea level records increase greatly in value. A considerable part of this paper is an extension of earlier work, and includes data from 1898 through 1962 at 44 stations on the various coasts of the United States, including Alaska, Canal Zone, and Hawaii. Each series shows changes with time in the level of the sea with respect to the adjacent land, but not to the center of the Earth. The series have been grouped by geographical areas, unique in their distribution of trends. The rate and extent of land uplift and sinking can be approximated by assuming a current rate of glacial-eustatic rise in sea level. G.D.C.

Higashi, Akira. *See* Corte, Arturo. 0521

0497 **Hindle, Robinson Joseph.** A post-glacial pollen diagram from Kingston, Rhode Island [abs.]: Dissert. Abs., v. 26, no. 1, p. 47, 1965.

0558 **Ho, Tong-yun.** Protein-nitrogen content in fossil shells as a new stratigraphic and paleoecologic indicator [abs.]: Dissert. Abs., v. 26, no. 1, p. 555, 1965.

Hodges, R. L. *See* Mathews, H. L. 0724

0889 **Hoffmeister, J. Edward; Multer, H. Gray.** Fossil mangrove reef of Key Biscayne, Florida: Geol. Soc. America Bull., v. 76, no. 8, p. 845–852, illus., table, 1965.

A small rock reef, extending along the northeastern shore of Key Biscayne, Florida, for a distance of about 400 yards and seaward for 115 yards, has been found to be composed of a framework of fossilized mangrove roots belonging to the black mangrove *Avicennia nitida*. The roots, now turned into calcareous rods, are embedded in a friable calcareous-quartzitic sand which may be quickly washed away by wave action along the seaward edge of the reef. In this manner, a lattice of roots in their original position is exposed. It is believed that this may be the first

reported occurrence of the fossilization of mangrove roots. Radiocarbon dating indicates the age of the rods to be between 1,000 and 2,000 years.—Authors' abstract

Holdaway, M. J. *See* Davis, Gregory A. 0980

0886 **Hollister, V. F.; Evans, J. R.** Geologic map of the Redding quadrangle, Shasta County, California: California Div. Mines and Geology Map Sheet 4, scale 1:24,000, section, text, 1965.

The explanatory text describes the Devonian to Quaternary rocks in the Redding quadrangle: Copley Greenstone, mixed rock, Mule Mountain stock, hornblende quartz diorite porphyry, Shasta Bally batholith, dikes, undifferentiated Cretaceous rock, Nomlaki Tuff, Red Bluff Formation, and Recent gravel, sand, silt, clay, and residual soils. An index map indicates the location of the quadrangle and the main bodies of intrusive rocks. Deposits of lode gold, placer gold, tungsten, copper, sand and gravel, and stone are listed and located by township and range.—M.C.M.

Holt, D. C. *See* Kauffman, A. J., Jr. 0969

Hopkinson, E. C. *See* Youmans, A. H. 0854

Hoskins, H. A. *See* Heck, H. T. 0695

0566 **Hostetler, P. B.** The degree of saturation of magnesium and calcium carbonate minerals in natural waters [with French abstract]: Internat. Assoc. Sci. Hydrology Pub. 64, p. 34–49, illus., tables, 1964.

Thermodynamic data bearing on the extent of complexing between the common ionic constituents of natural waters were used to calculate the distribution of Mg^{++}, Ca^{++}, and CO_3^{--} in published analyses of natural waters and to evaluate the degree of saturation of the waters with pure Mg and Ca carbonate minerals. Ground water from limestones usually is supersaturated with calcite and undersaturated with magnesite while the reverse is true for ultramafic rocks. Ground waters from limestones, dolomite, and ultramafic rocks are all generally supersaturated with respect to dolomite. Trace amounts of nesquehonite and hydromagnesite were found in waters from the ultramafic rocks. The studies were made on both United States and foreign occurrences.—M.C.

0644 **Hubbell, D. W.; Sayre, W. W.** Application of radioactive tracers in the study of sediment movement, *in* Federal Inter-Agency Sedimentation Conf., Jackson, Miss., 1963, Proc., Symposium 2—Sediment in streams: U.S. Dept. Agriculture Misc. Pub. 970, p. 569–578, illus., 1965.

Radioactive tracer techniques were employed to investigate the dispersion and transport of bed material in a test reach of the North Loup River near Purdum, Nebr. Sand particles, labeled with iridium-192, were used as tracers. A description of the experimental procedure is given. The results of the field study and subsequent laboratory flume studies indicate a potential for the wide application of radioactive tracer in sediment studies.—G.D.C.

Hubbell, D. W. *See* Sayre, W. W. 0682

0693 **Hubbell, David W.; Sayre, William W.** Sand transport studies with radioactive tracers [reply to discussions of paper 3900, 1964]: Am. Soc. Civil Engineers Proc., v. 91, paper 4464, Jour. Hydraulics Div., no. HY 5, pt. 1, p. 139–149, illus., 1965.

The writers agree with the discussers that tracer techniques, if correctly used and interpreted, are indeed powerful tools for measuring the transport and dispersion of bed material sediments. The precision of the results is limited by sampling statistics and the necessity for making certain assumptions in interpretation of data. These problems are as difficult as those associated with developing a theoretical model to describe the transport and dispersion process. Closing comments are grouped under topical headings: influence of vertical concentration gradient; distribution of rest periods; general two-dimensional model; diffusion model; bed

material discharge; and relation of descriptive models to sediment and flow phenomena.—G.D.C.

0539 **Hulston, J. R.; Thode, H. G.** Cosmic-ray-produced S^{36} and S^{33} in the metallic phase of iron meteorites: Jour. Geophys. Research, v. 70, no. 18, p. 4435–4442, illus., tables, 1965.

Spallation S–36 definitely has been found in the iron phase of three meteorites (Clark County, Piñon, and Tlacotepec), and spallation S–33 is also in evidence. The spallation S–33/S–36 ratios and absolute S–36 spallation yields are in general agreement with theoretical predictions. Further comparisons will be possible when Ar results are available for the specimens used in this work.—D.B.V.

Hunter, Richard G. *See* Chen, Ping-fan. 0627

0678 **Imam, Hassan Fahmy El-Sayed.** A viscoelastic analysis of mine subsidence in horizontally laminated strata [abs.]: Dissert. Abs., v. 26, no. 1, p. 295, 1965.

0926 **Ingalls, Arthur L.** Optical methods and equipment for processing geophysical data [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 49, no. 7, p. 1085, 1965.

Ingle, James C., Jr. *See* Bandy, Orville L. 0944

Ingram, L. F. *See* Cummins, R. S., Jr. 0643

Ives, J. D. *See* Falconer, G. 0666

Jeffery, W. G. *See* Muller, J. E. 0712

Jeletzky, J. A. *See* Cobban, W. A. 0885

Jenkins, C. T. *See* Moulder, E. A. 0571

0688 **Jensen, Mead L.** Reply [to discussion of "The kinetic isotope effect in the bacterial reduction and oxidation of sulfur" (1964) by H. R. Krouse, 1965]: Geochim. et Cosmochim. Acta, v. 29, no. 8, p. 1010–1011, 1965.

In reply to Krouse's comments, Jensen points out that the comparison of fractionation factor values in the paper by Nakai and Jensen (Geochim. et Cosmochim. Acta, v. 28, no. 12, p. 1893–1912, 1964) was made in the belief that there has been some confusion as to the extent of bacteriogenic isotope fractionation of sulfur in nature, and continues to suggest that environmental conditions in nature that approximate a closed system are suitable for the large fractionation factors inferred and determined from δ S–34 measurements on natural samples.—D.B.V.

0696 **Jillson, Willard Rouse.** The advance of geology in Kentucky during one hundred and thirty-four years (1784–1918): Kentucky Acad. Sci. Trans., v. 25, nos. 1-2, p. 48–57, 1964.

Comprehensive professional investigations in Kentucky began with a reconnaissance by W. W. Mather in 1838. Fifteen years later the "first" Geological Survey of Kentucky was organized, directed by D. D. Owen until his death in 1860. He produced such accurate stratigraphic sections for the Coal Measures that no important revision of these guideposts has been made since. With lapses in years there followed: the Second Survey, 1873–1893, directed first by N. S. Shaler and later by his office assistant, J. R. Proctor; the Third Survey, under Prof. C. J. Norwood, 1904–1912; and immediately thereafter the Fourth, directed until 1918 by J. B. Hoeing.—G.D.C.

Jobin, Daniel A. *See* Harrison, Jack E. 0482

Johnson, A. M. *See* Williams, E. G. 0704

Johnson, Howard P. *See* Beer, Craig E. 0665

0591 **Johnson, J. H.** Three Lower Cretaceous algae new to the Americas: Jour. Paleontology, v. 39, no. 4, p. 719–720, illus., 1965.

Three new fossil aigae are described and figured from Lower Cretaceous strata of North and South America. These are: *Lithophyllum? venezuelaensis* n. sp. (Corallinaceae) from Early Cretaceous strata in the Coast Ranges of Venezuela; *Permocalculus* cf. *P. irenae* Elliott (Gymnocodiaceae) from Early Cretaceous subsurface rocks of Karnes County, Texas; and *Salpingoporella texana* n. sp. (Dasycladaceae), also from Early Cretaceous subsurface rocks of Karnes County, Tex.—S.H.M.

0638 **Johnson, J. W.** Sand movement on coastal dunes, *in* Federal Inter-Agency Sedimentation Conf., Jackson, Miss., 1963, Proc., Symposium 3—Sedimentation in estuaries, harbors, and coastal areas: U.S. Dept. Agriculture Misc. Pub. 970, p. 747–755, illus., 1965.

At many localities along the Pacific Coast of the United States, considerable amounts of sand are moved inland each year by wind action in dune areas such as one near Santa Maria River mouth in California. Subsequent to earlier tests made to develop a suitable sand trap for measuring the rate of transport in the field, a larger wind tunnel was constructed and used for later tests described herein. In general it appears that the rate of transport adjusts itself quickly to a new windspeed. Moist sand must be dried before it can be moved, which requires higher windspeeds especially under humid air conditions.—G.D.C.

0541 **Johnson, Noye M.** An empirical isothermal decay law for the thermoluminescence of calcite: Jour. Geophys. Research, v. 70, no. 18, p. 4653–4662, illus., tables, 1965.

The isothermal decay behavior of both the 230°C and 320°C thermoluminescence in calcite can be described by a single trap law if two exponential components are assumed. The partition of thermoluminescence decay between the two exponential decay constants defined for each peak is a function of temperature. The age of a dike, calculated from the thermoluminescence in its limestone wallrock, is 47.5×10^3 or 53.7×10^3 (neglecting and including thermal effects, respectively). A maximum ambient temperature of 20°C for the outcrop was calculated from its equilibrium thermoluminescence.—D.B.V.

0534 **Johnston, F. J.** West Minnitaki Lake area (east sheet), District of Kenora: Ontario Dept. Mines Prelim. Geol. Map P.269, scale 1 in to 1/4 mi, text, 1965.

The text for this area appears on Map P.268, also by Johnston (1965).—M.C.M.

0680 **Johnston, F. J.** West Minnitaki Lake area (west sheet), District of Kenora: Ontario Dept. Mines Prelim. Geol. Map P.268, scale 1 in to 1/4 mi, text, 1965.

Trending northeast across the West Minnitaki Lake area are alternating belts of Precambrian sedimentary and volcanic rocks which are part of a major belt extending from the area west of Eagle Lake northeast to Savant Lake. Shear zones appear to be discontinuous and arranged en echelon, and no major fault structures are known. Contacts between the sedimentary and volcanic rocks are mostly covered by glacial drift. Interesting gold values have been reported but development has been meager; a band of iron formation contains local concentrations of pyrite and pyrrhotite; no significant amounts of sulfides have been found; and prospecting of a thorough nature will be required to compensate for lack of outcrop.—M.C.M.

Jones, D. L. *See* Packard, E. L. 0967

0569 **Jones, Paul H.** The velocity of ground-water flow in basalt aquifers of the Snake River Plain, Idaho [with French abstract]: Internat. Assoc. Sci. Hydrology Pub. 64, p. 225–234, illus., tables, 1964.

The maximum apparent velocity of ground-water flow in basalt aquifers beneath the eastern part of the Snake River Plain in southeastern Idaho has been measured with chemical and radioactive tracers for distances up to 3,500 feet in a single aquifer. Maximum apparent velocities observed in the single-aquifer test ranged from 24

to 141 feet per day, under hydraulic gradients of 0.21 to 1.06 feet in 1,000 feet. There was no relationship between the hydraulic gradient and the apparent velocity. Apparent rates of flow over distances in excess of 25 miles ranged from 12 to 16 feet per day, on the basis of the decay rate of tritium in the ground water.—Author's abstract

0896 **Juhan, Joe Paul.** Stratigraphy of the Evacuation Creek Member (Green River Formation), Piceance Creek Basin, northwestern Colorado: Mtn. Geologist, v. 2, no. 3, p. 123–128, illus., 1965.

The Evacuation Creek Member occupies 2,600 sq mi of the Piceance Creek Basin of northwestern Colorado. The Green River Formation within the Piceance Creek Basin forms a high table-land known as the Roan Plateau. The Evacuation Creek Member is the uppermost member of the Green River Formation and is exposed everywhere throughout the basin. The lithology of the Evacuation Creek Member consists mainly of discontinuous sandstones, siltstones, and marlstones. Correlation across the basin is possible once the base of the Evacuation Creek Member is established, but becomes increasingly difficult upward through the Member. The Evacuation Creek Member represents the final regressive cycle of lake deposition. The sediments were derived from the crystalline rocks in the adjacent uplifts and from pre-existing sediments derived from the surrounding borderlands during previous uplifts.—Author's abstract

0544 **Karrow, P. F.** (and others) Bedrock topography series—Grand Bend sheet: Ontario Dept. Mines Prelim. Map P.265, scale 1:50,000, 196[illegible].

0545 **Karrow, P. F.** (and others) Bedrock topography series—St. Marys sheet: Ontario Dept. Mines Prelim. Map P.266, scale 1:50,000, 1965.

0969 **Kauffman, A. J., Jr.; Holt, D. C.** Zircon—A review, with emphasis on West Coast resources and markets: U.S. Bur. Mines Inf. Circ. 8268, 69 p., illus., tables, 1965.

Potentially commercial concentrations of zircon are almost entirely in beach sand and stream placer deposits. Australia is the chief source, but a significant amount is obtained as a coproduct in mining of ilmenite in Florida. In western United States, resources of zircon, which are no better than marginal, include the following tonnages: in stream placers, Idaho 280,000, California 59,000, and Montana 44,000; and in beach sand, Oregon 110,000 and Washington 6,000. Zircon content is reported for many deposits in these areas and for some titaniferous sandstone in Montana. Uses and markets for and processing of zircon are reviewed.—A.P.B.

0701 **Keller, Allen.** Concerning cross sections: Jour. Geology, v. 73, no. 3, p. 498–504, illus., 1965.

Geologic cross sections are either general or specific. A general cross section is an abstract view of an area drawn along an imaginary line, and a specific section shows part of an area along a definite line. Restored sections show an area at a specified earlier time; outcrop sections show the rocks that are exposed; surface sections are continuous reconstructed sections down to any level of exposure; and deep sections go down to an arbitrary depth. Pictorial sections include landscape features in three dimensions. To interpret cross sections, it is helpful to examine the initial observations and assumptions used for their construction, and to examine the steps in reasoning used for reconstruction of the sequence of events in a series of restored sections.—Author's abstract

Kennedy, George C. *See* Seki, Yotaro. 0728

Kennedy, George C. *See* Newton, Mark S. 0987

0567 **Kennedy, Vance C.** Base-exchange capacity and clay mineralogy of some modern stream sediments [with French abstract]: Internat. Assoc. Sci. Hydrology Pub. 64, p. 95–105, illus., tables, 1964.

Stream sediments in the United States appear to show definite changes in clay mineralogy and exchange capacity with geographic location, probably due to climatic factors. In the east, kaolinite, illite, and dioctahedral vermiculite are the most common clay minerals in stream sediments but west of the Mississippi montmorillonite, illite, or mixed-layer montmorillonite-illite predominate. Stream clays range in exchange capacities from 14 meq/100 g in the Yadkin River, North Carolina to 63 meq/100 g for the Crooked River, Oregon. Stream sands high in fine-grained rock fragments may have exchange capacities as high as 12 meq/100 g. Mineralogy was determined by the X-ray diffraction method and the exchange capacity by the radioactive cesium method.—M.C.

Kerr, Paul F. *See* Liebling, Richard S. 0891

0925 **Kilkenny, John E.; VanAmringe, John H.** Exploring the "Asphalt Jungle" [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 49, no. 7, p. 1085, 1965.

0870 **Kinoshita, W. T.; Okamura, R. T.** A gravity survey of the island of Maui, Hawaii: Pacific Sci., v. 19, no. 3, p. 341-342, illus., 1965.

A Bouguer anomaly contour map of the island is based on a gravity survey made in 1962. Measurements were made relative to a base station at Kahului with an observed gravity value of 978,889.27 mgal and readings varied by less than 0.15 mgal. Coverage is good at the lower elevations but sparse in the higher, inaccessible parts of the volcanoes.—M.C.

0871 **Kinoshita, W. T.** A gravity survey of the island of Hawaii: Pacific Sci., v. 19, no. 3, p. 339-340, illus., 1965.

A Bouguer anomaly contour map of the island is based on a gravity survey made during part of 1961 and 1962. Good coverage is provided at elevations below 6,000 feet but is generalized for higher elevations. During the 30-day field work period, maximum variation in gravimeter readings at the base station at the Hawaiian Volcano Observatory was 0.7 mgal but about 90 percent of the readings were within 0.2 mgal.—M.C.

0924 **Kistler, Phillip S.** Procedures for prospecting highly explored areas [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 49, no. 7, p. 1085-1086, 1965.

0549 **Kisvarsanyi, Eva B.; Searight, Walter V.** Mineral resources and industry map of Missouri: Rolla, Mo., Missouri Div. Geol. Survey and Water Resources, scale 1:500,000, 1965.

0621 **Knollenberg, Robert.** The distribution of string bogs in central Canada in relation to climate—Office of Naval Research, Geography Br., Contract NONR 1202(07), Tech. Rept. 14: Madison, Wis., Univ. Wisconsin Dept. Meteorology, 44 p., illus., tables, 1964.

The climatic dependence of string bog formation seems to be established. The bogs are a true frost-soil form occurring with or without permafrost, in a region where precipitation exceeds evaporation and the freeze-thaw depths exceed 125 cm. Low-center polygons, long called true frost-soil forms, appear to have much the same climatic prerequisite, but form only above continuous permafrost. This study has revealed the need for further reconnaissance to the northwest. With a detailed analysis of all frost-soil forms certain climatic parameters of extremely large sub-polar areas could be obtained easily from aerial reconnaissance and aerial photography. String bogs and C-14 dating of muskeg may be of considerable value to the paleoclimatologist.—M.C.

0654 **Kramer, James R.** History of sea water—Constant temperature-pressure equilibrium models compared to liquid inclusion analyses: Geochim. et Cosmochim. Acta, v. 29, no. 8, p. 921-945, illus., tables, 1965.

An inorganic ocean is derived from the solution equilibrium of clay minerals, calcite, OH-apatite, CO_2-F-apatite, phillipsite, gypsum, strontianite, celestite, and aragonite; these minerals are considered in equilibrium in different combinations

with and without chloride. The presence or absence of chlorine seems to be the most important factor determining "fresh" or saline water concentrations. It is suggested that very ancient ocean water may have been quite similar in the composition and concentration to modern fresh water environments. Analyses of liquid inclusions from salt and chert from the Silurian Salina and Niagaran Groups are very similar to modern ocean compositions.—D.B.V.

0865 **Krivoy, Harold L.** A gravity survey of the island of Niihau, Hawaii: Pacific Sci., v. 19, no. 3, p. 359–360, illus., 1965.

Gravity data collected on Niihau support geologic evidence that the island is an erosional remnant of a dead shield volcano whose center of volcanism was just east of the present Niihau highlands. Bathymetric and gravity evidence offer clues to a genetic link between Niihau and west Kauai; on shore gravity suggests a continuous Bouguer high connecting the two regions. This link would be in accord with ocean-bottom topography, which shows a prominent ridge rising above sea level at Niihau and Kaula Rock to the west.—Author's abstract

0866 **Krivoy, Harold L.; Baker, Melville, Jr.; Moe, Eugene E.** A reconnaissance gravity survey of the Island of Kauai, Hawaii: Pacific Sci., v. 19, no. 3, p. 354–358, illus., table, 1965.

A large Bouguer anomaly on Kauai, similar to anomalies found at most of the other major volcanoes of the Hawaiian Islands, lies about 10 miles east of the caldera indicated by geologic mapping. Another gravity high suggests a second center of volcanism just west of the island. Average Bouguer values on Kauai are higher than on other Hawaiian islands, indicating either that the crust beneath Kauai is 1–2 km thinner than it is beneath the eastern part of the Hawaiian chain, or the zone of increased density in the dike complex lies closer to the surface at Kauai than do similar cores within the other islands of the chain.—Authors' abstract

0869 **Krivoy, Harold L.; Lane, Michael P.** A preliminary gravity survey of the island of Lanai, Hawaii: Pacific Sci., v. 19, no. 3, p. 346–348, illus., table, 1965.

A Bouguer anomaly contour map of the island is based on an earlier gravity survey. Measurements were made relative to two base stations at Lanai Airport and Lanai Inn with a base value of 978.84757 gal. Because of the accumulation of low density material at the surface, an elevation correction factor of 0.0695 mgal/ft was used in reducing Lanai data for the map, this factor corresponding to a density of 2.0 g/cc. The 40-mgal anomaly centered over the Palawai Basin is the major gravity feature and corresponds to the 40–60-mgal anomalies over other Hawaiian volcanoes. A geologic interpretation of 1940 that the Lanai plateau and its contemporary depressions are remains of the old center of volcanism of Lanai Volcano seems to be confirmed by the gravity survey.—M.C.

0864 **Kroenke, Loren W.; Woollard, George P.** Gravity investigations on the leeward islands of the Hawaiian Ridge and Johnston Island: Pacific Sci., v. 19, no. 3, p. 361–366, illus., 1965.

Surveys were made in 1964 of the small islands and atolls along the Hawaiian Ridge from Nihoa to Midway as well as Johnston Island. Gravity stations were established on and Bouguer anomaly maps were made for Nihoa, Laysan, Lisianski, Pearl and Hermes Reef, Midway and Johnston and Sand Islands. All the islands on the Ridge are characterized by high gravity values with Bouguer values approaching +300 mgal, including the coral atoll islands, and have pronounced gradients of about 10 mgal per mile apparently related to a primary volcanic pipe rather than to topographic configuration. Johnston Island has absolute Bouguer anomaly values somewhat lower than those of the Hawaiian group, its map having intervals from 242 to 247 mgal.—M.C.

0872 **Kroenke, Loren W.** Seismic reflection studies of sediment thickness around th.. Hawaiian Ridge: Pacific Sci., v. 19, no. 3, p. 335–338, illus., 1965.

The surveys were made in 1964 along seven tracks lying north and south of Oahu and northeast and south of Molokai. An average velocity of 2 kmps was assumed

for Hawaiian Ridge sediments based on data from refraction seismic measurements north of the Ridge. Both north and south of the Ridge, the sediment thickness increases as the base of the Ridge is approached and the sub-bottom topography dips toward the Ridge on both sides until the base of the slope is encountered, thus suggesting faulting at the base of the slope. An alternate explanation would be simple migration of the axis of the depositional basin inward towards the Hawaiian Ridge as it sank. Although slumping or volcanic flows appear to mask most of the base, sub-bottom sedimentary structure strongly suggests progressive downwarping.—M.C.

0720 **Krouse, H. R.** Comment on a paper by Nobuyuki Nakai and M. L. Jensen, "The kinetic isotope effect in the bacterial reduction and oxidation of sulfur" [1964]: Geochim. et Cosmochim. Acta, v. 29, no. 8, p. 1009–1010, 1965.

It is pointed out that if the chemical reduction studies were to be carried out to larger percentage reactions, the fractionation factor should follow equation (9) of Nakai and Jensen (Geochim. et Cosmochim. Acta, v. 28, no. 12, p. 1893–1912, 1964) and their results would be close to the theoretically realizable inorganic chemical fractionation factors of Harrison and Thode (Faraday Soc. Trans., v. 53, p. 1648–1651, 1957). It is proposed that K_1/K_2 be used in directly intercomparing laboratory isotope fraction studies.—D.B.V.

0511 **Kulm, LaVerne Duane.** Sediments of Yaquina Bay, Oregon [abs.]: Dissert. Abs., v. 26, no. 1, p. 314–315, 1965.

0884 **Kume, Jack; Hansen, Dan E.** Geology and ground water resources of Burleigh County, North Dakota—Pt. 1, Geology: North Dakota Geol. Survey Bull. 42, pt. 1 (North Dakota Water Conserv. Comm. County Ground Water Study 3), p. 1–92, illus., tables, geol. maps, 1965.

This portion of the Glaciated Missouri Plateau is dominated by extensive glacial features overlying Precambrian granite and 8,000 feet of Paleozoic–Cenozoic sedimentary rocks with surface exposures limited to one Tertiary and three Cretaceous groups. Because of four Wisconsin ice advances, the Pleistocene formations dominate, with the Napoleon, Long Lake, and Burnstad Drifts forming glacial morphostratigraphic units. Pleistocene Mollusca are represented by 19 genera of pelecypods and gastropods (described in detail in a paper by S. J. Tuthill, cited separately). Resources are water and limited amounts of construction materials and lignite. Extensive test drilling has revealed no oil for commercial production.—M.C.

0685 **Kuno, Hisashi.** Fractionation trends of basalt magmas in lava flows: Jour. Petrology, v. 6, no. 2, p. 302–321, illus., tables, 1965.

Chemical compositions of segregation veins in basalt flows are compared with those of the host rocks for tracing fractionation trends of magmas after extrusion. In tholeiite from Hawaii and Japan and in Warner high-alumina basalt from California, total iron increases markedly during fractionation while SiO_2 is nearly constant, but in Sicilian tholeiite both iron and SiO_2 increase. In basaltic andesites of the hypersthenic or calc-alkali rock series in California and Japan, iron is almost constant or decreases while SiO_2 increases. The trend to marked increase of iron occurs in flows with lower Fe_2O_3–FeO ratios and to constant iron, with higher ratios, so that trends may arise largely from the difference in oxygen partial pressure of magmas during fractionation, with higher oxygen pressure being caused by higher initial water content in magmas.—M.C.

0923 **LaCoste, Lucien J. B.** Stabilized platform shipboard or airborne gravity meter [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 49, no. 7, p. 1086, 1965.

Lane, Michael P. *See* Krivoy, Harold L. 0869

0959 **Langmuir, Donald.** Stability of carbonates in the system MgO–CO_2–H_2O: Jour. Geology, v. 73, no. 5, p. 730–754, illus., tables, 1965.

In a review and new interpretation of data on the minerals artinite, hydromagnesite, lansfordite, magnesite, and nesquehonite, Langmuir arrives at parameters for entropy in E. U. at 25°C and atmospheric pressure and enthalpies and free energies of formation in cal/mol at 25°C and atmospheric pressure.—F.B.

0579 **Lara, Joe M.** Sediment transportation mechanics—Nature of sedimentation problems—Discussion [of paper 4260 by L. C. Gottschalk, 1965]: Am. Soc. Civil Engineers Proc., v. 91, paper 4464, Jour. Hydraulics Div., no. HY 5, pt. 1, p. 319-320, 1965.

The suggestion is made here to include a proportionality expression introduced by E. W. Lane (1965), because it portrays the basic principle of equilibrium. Additional problems not included in the Task Committee paper relative to sediment deposits in lakes and reservoirs are: (1) reservoir evaporation losses owing to sediment encroachment, (2) turbidity currents capable of carrying large quantities of fine sediment to the deepest parts of the reservoir, and (3) progressive deposition of sediments in the reservoir delta areas, which affects the backwater profile.—G.D.C.

0598 **Lattman, Laurence H.; Ray, Richard G.** Aerial photographs in field geology: New York, Holt, Rinehart and Winston, 221 p., illus., 1965.

The text, designed for college students, ranges from a simple discussion of what kind of photographs to buy to an elaboration of specific procedures used in the field to locate ground positions and to plot and record field data on aerial photographs, including some that can be done at base camp. Emphasis is placed on vertical photographs, the type commonly used by field geologists. A brief chapter on geologic interpretation of airphotos, and another devoted to high-oblique photographs which may be taken by the field geologist and used for plotting are included. A glossary of terms used in the text completes the volume.—G.D.C.

Lau, L. Stephen. *See* Sunn, Franklin Y. K. 0577

0560 **Leith, C. J.** The influence of geological factors on the stability of highway slopes: Soc. Mining Engineers Trans., v. 232, no. 2, p. 150-153, illus., 1965.

In studies of over 400 slope failures in North Carolina highway cut slopes, it was found that the percentage of failure was greatest in micaceous metasediments, gneisses, and schists and in saprolite and soil derived from these rock types. Soil slope failures outnumber the rock slope type by 2 to 1. Joints and similar planes of separation influence the size and shape of sliding masses but may or may not act as failure surfaces. Climatic factors are indicative of weathering conditions but do not correlate well with slope failure frequency.—M.C.

Leopold, Luna B. *See* Emmett, William W. 0646

0656 **Lerman, Abraham.** Paleoecological problems of Mg and Sr in biogenic calcites in light of recent thermodynamic data: Geochim. et Cosmochim. Acta, v. 29, no. 8, p. 977-1002, illus., tables, 1965.

Shells of two Late Cretaceous and one Recent species of ostreid pelecypods were analyzed for Mg and Sr; these calcites are found to be not in equilibrium with the $a_{Mg^{++}}/a_{Ca^{++}}$ ratio found in Recent sea water. The Sr concentrations in these and in a Late Cretaceous belemnite can be accounted for by Nernst's distribution equilibrium with respect to the Sr/Ca ratio as in Recent seas. A combined record of Mg and Sr, treated as an incomplete ternary free energy surface, may accentuate differences between geographically distinct populations. Approximate calculation of the activity coefficients of the components in magnesian calcites at 25°C is given in an appendix.—D.B.V.

0891 **Liebling, Richard S.; Kerr, Paul F.** Observations on quick clay: Geol. Soc. America Bull., v. 76, no. 8, p. 853-878, illus., tables, 1965.

Quick clays studied contain an average by weight of 57.3 percent less than 2-μ material; non-quick clays average 31.6 percent less than 2-μ material. Principal minerals in clay-size fraction of quick clays are sheet-layer silicates. Illite

(hydromica) and chlorite occur most frequently. Pore-water salinity changes from about 35 g per l when clay is deposited to 0.2–15 g per l at flowage. Pore-water content in quick clays may be as high as 80 percent. Major critical conditions for quick-clay movement appear to be: 40 percent or more by dry weight of layer-lattice silicates of colloidal size, 44 percent or more of pore water, electrolyte concentration below 5 grams of salt per liter, and addition of a dispersant. Under such conditions a clay becomes critically sensitive and may flow spontaneously or as result of shock.—H.C.W.

0476 **Ling, Hsin-Yi.** The tintinnid *Parafavella gigantea* (Brandt), Kofoid and Campbell, 1929, in the North Pacific Ocean: Jour. Paleontology, v. 39, no. 4, p. 721–723, illus., table, 1965.

A single specimen from the North Pacific Ocean remarkable for the length of the aboral horn and the high ratio of the length of the aboral horn to that of the entire lorica, is provisionally assigned to *Parafavella gigantea* s.l. The specimen appears to be intermediate in morphology between specimens assigned to this species by Hada (1932) and by Campbell (1942).—J.F.M.

0550 **Lintz, Joseph, Jr.** (editor) Conference on the history of geology, University of Nevada, Reno, 1964—Guidebook of the field trips: [Reno] Mackay School of Mines, 35 p., illus., tables, 1964.

This guidebook was prepared for two trips out of Reno, Nev.: one circling Lake Tahoe in California and Nevada; the other eastward in the Basin and Range area to Fairview Peak and back through Virginia City. The editor has drawn liberally from the earlier published geology of the area and from his colleagues, for ideas. A general geologic column is included.—G.D.C.

0546 **Lipman, Peter W.; McKay, Edward J.** Geologic map of the Topopah Spring SW quadrangle, Nye County, Nevada: U.S. Geol. Survey Geol. Quad. Map GQ-439, scale 1:24,000, sections, 1965.

Lipman, Peter W. *See* Davis, Gregory A. 0980

0650 **Livesey, Robert H.** Channel armoring below Fort Randall Dam, *in* Federal Inter-Agency Sedimentation Conf., Jackson, Miss., 1963, Proc., Symposium 2—Sediment in streams: U.S. Dept. Agriculture Misc. Pub. 970, p. 461–470, illus., 1965.

The rapid channel armoring which developed in the Missouri River below Fort Randall Dam in South Dakota significantly arrested the desired degradation trend. Three contributing elements prevailed in this reach: the degradation trend, regulation of flows to reduce high discharges, and presence in streambed of relatively nonmoving size material plus finer grades. Less than a single layer of larger particles is sufficient for a total armoring effect, which is due to the development of a natural filter below the surface layer to prevent leaching of finer underlying material. The surface materials are shingled, appearing to reduce the maximum surface coverage. Further degradation may be encouraged by disturbing this armor surface with artificial scarifying or jetting action.—G.D.C.

0690 **Lo, Kwan Yee.** Stability of slopes in anisotropic soils: Am. Soc. Civil Engineers Proc., v. 91, paper 4405, Jour. Soil Mechanics and Found. Div., no. SM 4, pt. 1, p. 85–106, illus., tables, 1965.

In macroscopically homogeneous soils, shear strength may vary with the direction of applied major principal stress. A review of reliable data from block samples indicates that there are at least two types of anisotropy. The vertical principal strength may be greater or less than the horizontal strength. An extensive study on one lightly overconsolidated glacial soil from Welland, Ontario, shows that the angle between failure plane and plane normal to the direction of stress is independent of the latter direction. A mathematical method of stability analysis can be used for cases in which vertical strength is (a) constant with depth, and (b) increases linearly with depth. For steep slopes, the effect of anisotropy is small, but for flatter slopes it is significant.—G.D.C.

0737 **Lockett, John B.** Phenomena affecting improvement of the lower Columbia estuary and entrance, *in* Federal Inter-Agency Sedimentation Conf., Jackson, Miss., 1963, Proc., Symposium 3—Sedimentation in estuaries, harbors, and coastal areas: U.S. Dept. Agriculture Misc. Pub. 970, p. 626–669, illus., tables, 1965.

In this paper past concepts are examined of phenomena controlling the regimen of this area at the mouth of the Columbia River near Astoria, Oreg., as related to work undertaken to improve its navigability. New concepts emphasize the relation of salinity intrusion and littoral movement to degree of shoaling. Statistical wave studies, analyses of offshore changes, studies of attrition and accretion of adjacent shorelines, and comprehensive investigations of the distribution of Columbia River sediments are reviewed. Bathymetric charts of several years are presented; one is dated 1792. Considerations for the future under controlled upland discharge are outlined.—G.D.C.

Løken, O. H. *See* Falconer, G. 0666

0922 **Long, J. A.** Examples of optical analysis and filtering of seismic record sections [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 49, no. 7, p. 1086–1087, 1965.

Loring, D. H. *See* Nota, D. J. G. 0669

0615 **Lovering, T. S.** Some problems in geothermal exploration: Soc. Mining Engineers Trans., v. 232, no. 3, p. 274–281, illus., 1965.

Geothermal energy sources may be hot springs in areas of nearly normal heat flow or hyperthermal areas where water is heated by a relatively concentrated source related to volcanicity. If a geologic trap to act as a steam boiler is present, as in Larderello, Italy, the hyperthermal area will have a convecting system which develops superheated water at relatively shallow depths and may provide large amounts of natural steam. For the area to be productive for long periods, underflow into the reservoir must be slow enough to heat it and production rate must not exceed underflow rate. Best exploration spots are hot spring, fumarole, or Quaternary volcanic areas, but blind potential sources, such as East Tintic area, Utah, may be found by measurement of geothermal gradient.—M.C.

0692 **Lowman, F. G.; Quiñones, L.; Miró, M.; Oliver de Padovani, I.; Ramos, E.; Román de Vega, V.; Bielen, H. J.** Investigations of trace element distribution in marine waters and sediments [with Spanish and Portuguese abs.], *in* Inter-American symposium on the peaceful application of nuclear energy, 5th; Valparaíso, Chile, 1964; Washington, D. C., Pan American Union, p. 241–259, illus., tables, 1965.

Distributions of Sc, Cr, Mn, Fe, Ni, Zn, Mg, Ca, and Sr in marine waters and sediment cores were determined in an area offshore from the Añasco River watershed and Añasco Bay in Puerto Rico. Rocks and minerals in the watershed are mainly extrusive igneous, andesitic, and basaltic rocks and sedimentary rocks containing volcanic or igneous debris. Sediments were collected with an orange-peel grab and a piston coring tube and analyses for the various elements were made by neutron activation, atomic absorption spectrometric, and flame spectrometric methods. In marine sediments Mn, Fe, and Sc contents are inversely related to distance from shore, Ca and Sr contents are directly related, and Mg, Zn, Ni, and Cr contents show no relation.—M.C.

Ludwig, William J. *See* Ewing, Maurice. 0670

0850 **Macdonald, Gordon A.** The lithologic constitution of the crust and mantle in the Hawaiian area: Pacific Sci., v. 19, no. 3, p. 285–286, 1965.

Most data on the crust and mantle in this area comes from interpretation of geophysical studies. Because of the presence of tholeiitic basalt in Hawaiian mountains above sea level and in dredged submarine samples as well as evidence of isostatic sinking of the older islands, the crust here appears to consist primarily of tholeiitic basalt and a hole through the Moho would give direct data on composition of the suboceanic "B layer." Even less is known about the mantle but available evidence seems to indicate that the mantle consists of a peridotite

approaching the composition of the stony phase of stony meteorites, or the theoretical "pyrolite" of Lovering, undergoing a phase change at depth to olivine–garnet pyroxenite.—M.C.

0873 **Macdonald, Gordon A.** Hawaiian calderas: Pacific Sci., v. 19, no. 3, p. 320–334, illus., table, 1965.

Calderas formed by collapse during the last stages of growth of shield volcanoes built by frequent eruptions of tholeiitic basalt; they range from 2–12 mi across, have sunk several thousand feet, and in part have grown from coalescence of smaller collapse craters. All are partly or wholly filled by continued eruption. Revelation by gravity studies of masses of ultra-dense rocks a few feet below the surface of several volcanoes has led to the theory that calderas may have formed by isostatic sinking of a heavy rock column. The idea appears to be negated by the fact that some calderas have no associated gravity high, in others the high is offset to one side, and some highs are not associated with any apparent caldera collapse. Caldera formation probably depends on formation of a magma reservoir within the mass of the shield volcano with its top within a few km of the shield summit.—M.C.

0904 **MacGregor, J. R.** Quantitative determination of reservoir pressures from conductivity log: Am. Assoc. Petroleum Geologists Bull., v. 49, no. 9, p. 1502–1511, illus., 1965.

A method of plotting conductivity readings of clean shales versus depth in coastal and offshore Louisiana wells shows that a sloping straight line can be drawn through the points in the known normally pressured section, whereas the points in the abnormally pressured zone deviate toward higher conductivity. A basic curve is developed which can be used to determine approximate pressures in future wells where electric logs can be made available but where actual pressure measurements are lacking.—E.E.G.

0852 **Machesky, L. E.** Gravity relations in American Samoa and the Society Islands: Pacific Sci., v. 19, no. 3, p. 367–373, illus., 1965.

Gravity studies were carried out in 1964 on the islands of Tutuila, Ofu, Olosega, and Tau in American Samoa and on Tahiti and Moorea in French Polynesia and Bouguer anomaly maps were prepared for each island. The resulting features were somewhat like those of the Hawaiian group but on a smaller scale.—M.C.

Machesky, L. F. *See* Strange, William E. 0867

0633 **Mackay, J. Ross.** Gas-domed mounds in permafrost, Kendall Island, N.W.T. [with French abstract]: Canada Dept. Mines and Tech. Surveys Geog. Br. Geog. Bull., v. 7, no. 2, p. 105–115, illus., 1965.

Four mounds, filled with methane and other gases generated by anaerobic decay of plant material, were discovered in 1963. When the mounds were bored, the drill rods penetrated into a cavity from which the gas escaped. The three small mounds collapsed within a day after release of the gas while the largest one apparently collapsed in the fall of 1963, for it was filled by a lake in 1964. The mounds probably formed when permafrost spread across a lake bottom, over unfrozen lake muds evolving methane, as a result of a critical combination of lake depth, summer thaw, and winter freeze. Combined evidence of a favorable sequence of climatic events, vegetation type, presence of a small tundra polygon fissure, and tritium dating of ice crystals on the inside ceiling of a mound indicates a date of 1950 with the most favored date being 1945.—M.C.

0971 **Mackenzie, F. T.; Garrels, R. M.** Silicates—Reactivity with sea water: Science, v. 150, no. 3692, p. 57–58, illus., 1965.

Silicate minerals rapidly release silica to sea water. Fine-grained, 1-gram samples were placed in 200 milliliters of sea water, and the silica content of the water was measured intermittently for 6 months. At the end of 10 days and of 6 months the silica concentrations with various minerals, in parts per million, were, respectively: kaolinite, 0.6, 2.2; chlorite, 2.5, 2.4; illite, 1.8, 2.6; muscovite,

1.8, 3.9; montmorillonite A, 7, 10.5; montmorillonite B, 10, 21. Except for ion exchange phenomena, it generally has been assumed that these minerals do not react significantly with sea water, or, if they do, they react at geologically slow rates. The rates observed indicate that the ocean must be looked upon as a chemical system with a rapid response to added detrital silicates.—Authors' abstract

0711 **Maderak, M. L.** Chemical quality of ground water in the Minneapolis-St. Paul area, Minnesota: Minnesota Conserv. Dept. Div. Waters Bull. 23, 44 p., illus., tables, 1965.

In this area of about 2,500 sq mi, almost every formation will yield some water, but large amounts come from the glacial drift, St. Peter Sandstone, Shakopee and Oneota Dolomites, Jordan Sandstone, Franconia and Galesville Sandstones, and the Mount Simon and Hinckley Sandstones of Winchell (1886). Almost all ground water, as well as surface water, is the calcium bicarbonate type. Four isochron maps indicate that, except for recharge areas, the dissolved solids in water from the major aquifers are lowest in the eastern and northeastern part of the area, and highest in the western or southern part. The average concentration is highest in the drift and lowest in the Jordan Sandstone. A comparison of chemical analyses from 1899 to 1963 shows little natural change in quality.—G.D.C.

0863 **Malahoff, Alexander; Strange, William E.** The paleomagnetic significance of aeromagnetic surveys of the Hawaiian Islands: Pacific Sci., v. 19, no. 3, p. 390-392, table, 1965.

Aeromagnetic surveys of the Hawaiian Islands have revealed that the primary magnetic anomalies associated with the islands are dipole anomalies caused by the intrusive rocks of the volcanic centers and rift zones. Comparison of the direction of magnetization indicated by the dipole anomalies with results of laboratory measurements on lavas show that in many cases the lavas possess reverse polarization while the intrusive rocks are normally polarized. These results must be taken into account when interpreting the magnetic field of submerged marine volcanic features such as seamounts and when establishing periods of reversal in the earth's magnetic field.—Authors' abstract

Mallory, Bob. *See* Valentine, J. W. 0955

0676 **Maner, Sam B.** Geology in sediment delivery ratios, *in* Federal Inter-Agency Sedimentation Conf., Jackson, Miss., 1963, Proc., Symposium 1—Land erosion and control: U.S. Dept. Agriculture Misc. Pub. 970, p. 108-110, 1965.

The link between drainage basin geology and sediment delivery ratio is the drainage-network elements. The scale, shape, and distribution of these elements are initially a function of geologic structure and lithology; currently they are conditioned by the kinds of geomorphic processes active in a given area, and by the length of time the processes have been active. This interrelation indicates the current stage of the geomorphic cycle to be a prime factor in determining which of the drainage basin characteristics are best related, quantitatively, to sediment delivery ratio. G.D.C.

0875 **Manghnani, Murli H.; Woollard, George P.** Ultrasonic velocities and related elastic properties of Hawaiian basaltic rocks: Pacific Sci., v. 19, no. 3, p. 291-295, illus., tables, 1965.

Compressional- and shear-wave velocities of basaltic rocks were measured by the pulse and P-wave transducers techniques, respectively. The maximum compressional-wave velocity, 7.0 kmps under surface conditions, was found in an amphibolitic intrusive dike rock with a density of 3.0 gm/cc originating in Koolau Caldera, Oahu. An eclogite from the same area had a density of 2.81 gm/cc and a velocity of 6.2 kmps, but would have equalled the amphibolitic rock except for alteration occurring during eruption. In terms of seismic velocity, these high density, high-velocity rocks represent the constituents of mantle-like material in the caldera, for under upper mantle oceanic conditions the velocity would be 7.5-7.8 kmps.—M.C.

0512 **Manley, Thomas Richard.** The Niagaran rocks of Drummond Island, Michigan, and the related rocks of the Michigan Basin [abs.]: Dissert. Abs., v. 26, no. 1, p. 315, 1965.

0698 **Mansur, Charles I.; Dietrich, Rudy J.** Pumping test to determine permeability ratio: Am. Soc. Civil Engineers Proc., v. 91, paper 4415, Jour. Soil Mechanics and Found. Div., no. SM 4, pt. 1, p. 151–183, illus., tables, 1965.

This test was made on a 16-in. well, 100 feet deep, in Recent alluvium on the left bank of the Arkansas River, near Pine Bluffs, Ark., to determine aquifer permeability coefficients for use in seepage and dewatering studies for planned dams and locks. The average ratio of horizontal to vertical permeability is on the order of 2.0, which is the value recommended for lock and dam sites on the lower Arkansas River and for the sand strata in its lower alluvial valley where silt or clay seams are significantly nonexistent. The presence of impervious layers of significant extent would complicate and probably invalidate the methods described.—G.D.C.

0597 **Martin, Lawrence.** The physical geography of Wisconsin (3d edition): Madison, Wis., Univ. Wisconsin Press, 608 p., illus., tables, 1965; originally published 1916.

The immensely varied topography of Wisconsin provides examples of nearly every important physiographic process and topographic form. This work offers a clear explanation of these and many other physiographic processes. Well supplied with maps, charts, and illustrations it is a supplementary reader or guide in field trips for geography courses at all levels. The second edition in 1932 had minor changes in statistical data. The present volume is reprinted from the 1932 edition.—G.D.C.

0653 **Masch, Frank D.; Espey, William H., Jr.; Moore, Walter L.** Measurements of the shear resistance of cohesive sediments, *in* Federal Inter-Agency Sedimentation Conf., Jackson, Miss., 1963, Proc., Symposium 1—Land erosion and control: U.S. Dept. Agriculture Misc. Pub. 970, p. 151–155, illus., 1965.

A rotating cylinder test apparatus designed to measure low shear stresses is described, which gives a value of the true shear stress on a sediment sample and a measurement which is independent of such uncertainties as roughness changes and boundary layer growth. A standard test procedure is outlined, and results of several laboratory tests on Taylor marl of Texas are presented. It now appears feasible to investigate the effect of various properties of the sediment on the critical shear causing scour. Tests can best be performed on remolded samples.—G.D.C.

Mason, Brian. *See* Wiik, H. B. 0719

0724 **Mathews, H. L.; Hodges, R. L.; Amos, D. F.** Some geological and geomorphological observations of Chesterfield County [abs.]: Virginia Jour. Sci., new ser., v. 16, no. 4, p. 380–381, 1965.

0611 **Mauger, R. L.; Damon, P. E.; Giletti, B. J.** Correction—Isotopic dating of Arizona ore deposits: Soc. Mining Engineers Trans., v. 232, no. 3, p. 217, 1965.

On page 85 of the March 1965 issue of Transactions the heading of the third data column of Table II should read Ar^{40} *Atmos* percent, and the first decay constant at the bottom of the Table should read $\lambda\beta$.—Authors' text

0921 **Mayne, Harry W.** Common reflection point techniques in highly explored areas [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 49, no. 7, p. 1087, 1965.

Maynes, A. D. *See* Albee, A. L. 0686

Mayuga, M. N. *See* Savit, Carl. 0910

0645 **McDowell, L. L.** Sediment movement as defined by radioactive tracers—A preliminary report, *in* Federal Inter-Agency Sedimentation Conf., Jackson, Miss., 1963, Proc., Symposium 2—Sediment in streams: U.S. Dept. Agriculture Misc. Pub. 970, p. 550–568, illus., 1965.

In this investigation the radioisotope scandium-46 was utilized to measure the sediment transport velocity and sediment discharge of sand in a small laboratory flume. In addition to the specific investigation a summary is given of the literature, most of which deals with estuaries and sea bottoms and is largely qualitative in nature. The present laboratory investigation is concerned with the origin and routing of sediment in agricultural watersheds.—G.D.C.

0920 **McGee, David C.** Upper Cretaceous (Campanian) Foraminiferida from Punta Baja, Baja California [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 49, no. 7, p. 1087, 1965.

0641 **McHenry, J. Roger; Hawks, Paul H.** Measurement of sediment density with gamma probes, *in* Federal Inter-Agency Sedimentation Conf., Jackson, Miss., 1963, Proc., Symposium 4—Sedimentation in reservoirs: U.S. Dept. Agriculture Misc. Pub. 970, p. 899-908, illus., 1965.

Many types of sediment samplers have been developed for taking undisturbed cores for volume-weight measurements, but even with many improvements their operation in underwater sediments has not been completely satisfactory. In recent nuclear techniques in situ, the single-probe system is unsuitable for use in narrow bands and near interfaces of sediments. A dual-probe device is described by which such measurements can be made with precision equal to that obtained for larger masses with single probe. For performance in the field the dual-probe needs modification. Tests were made in laboratory and reservoir sediments.—G.D.C.

McKay, Edward J. *See* Lipman, Peter W. 0546

0481 **McManus, Dean A.** A large-diameter coring device: Deep-Sea Research, v. 12, no. 2, p. 227-232, illus., table, 1965.

A 15 cm-diameter coring device of polyvinyl chloride has been developed for use in submarine sediment sampling and has been tested successfully with barrels as much as 6 m long, with no sediment distortion. The large-diameter corer is especially useful in obtaining samples for analyses, such as radiocarbon dating, organic geochemistry of sediment, or chemistry of the interstitial fluid, where larger volumes of sediments are required.—M.C.

0484 **McMaster, William M.** Geology of the Elkmont quadrangle, Alabama-Tennessee: U.S. Geol. Survey Misc. Geol. Inv. Map I-419, scale 1:24,000, section, separate text, 1965.

The rocks exposed in the Elkmont quadrangle consist chiefly of limestone and siliceous dolomite and range in age from Middle Ordovician to Early Mississippian. The quadrangle lies on the southern flank of the Nashville dome and the regional dip is to the southwest. Rock-collapse features caused by extensive solution are common.—M.C.M.

0620 **McMeen, James A.** Ground water supply for the city of Canton, South Dakota: South Dakota Geol. Survey Spec. Rept. 31, 40 p., illus., tables, 1964.

The Canton area, a gently rolling plain, is underlain in descending order by Quaternary alluvial and glacial deposits, Cretaceous rocks with Niobrara Marl where present, as the top layer and then Carlile Shale, Greenhorn Limestone, Graneros Shale, and the Dakota Group, the latter forming the principal aquifer, and then by the Precambrian Sioux Quartzite as the basement rock. The Dakota Group sandstones produce water of good quality in wells from 250 to 585 feet deep but, because of the rock structure, can supply only 75-100 gpm. An additional source may be found in outwash deposits along the Big Sioux River if the water quality is satisfactory. Recommendations include drilling of wells deep enough to penetrate all the sandstones of the Dakota Group for additional supplies if the outwash water is unsatisfactory.—M.C.

0919 **McMurry, H. V.** Optimum use of the geophysical tools in explorations for base metal ores [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 49, no. 7, p. 1087, 1965.

0725 **Meintzer, Robert; Plaster, Roger; Ellison, Robert L.** Distribution of Foraminifera in the lower York estuary, Virginia [abs.]: Virginia Jour. Sci., new ser., v. 16, no. 4, p. 381, 1965.

0956 **Melton, Mark A.** Debris-covered hillslopes of the southern Arizona desert—Consideration of their stability and sediment contribution: Jour. Geology, v. 73, no. 5, p. 715–729, illus., tables, 1965.

Slopes of less than 28.5° are "stable", although covering granitic debris is "mobile" and volcanic debris is "fixed"; the difference is related chiefly to the rate of production of boulders from bedrock. Steeper slopes are increasingly unstable, and those steeper than about 36° rarely are debris-covered. The upper limit of debris-covered slopes is about the angle of repose of the debris. The 28.5° and 36° stability limits are related to frictional properties of fragments. Fine gravel and sand move off slopes, but boulders remain through multiple climatic cycles. Only a low correlation was found between slope angle and block size. It is suggested that the concepts of the boulder-controlled slope and the repose slope be abandoned.—D.R.M.

0684 **Mendiola Martínez, José.** Estudio geológico de la porción norte de la Cuenca Chicontepec, Estado de S.L.P.: Geología y Metalurgía, v. 2, no. 12, p. 18–61, illus., tables, 1965.

The Chicontepec sedimentary basin or "antefossa" of Mexico is located between the Tampico–Nautla basin and the Sierra Madre Oriental front. Anticlinal structures of the north part were explored for petroleum. Formations penetrated range from Paleocene Chicontepec to Permian–Triassic metamorphic basement complex. The Jurassic marine Huayacocotla, Tamán, and Pimienta Formations are considered petroleum source rocks. El Abra reef and other Cretaceous formations generally have low porosity and show no oil accumulation. Upper Cretaceous Agua Nueva yields some gas and condensate from the Maguey no. 2-A well; its higher porosity is due to intense fracturing. The other seven wells are dry. Upper Jurrasic Tamán shows slight secondary porosity; the structurally higher parts or the border of the basin should be drilled to penetrate the Tamán in its clastic facies.—V.M.J.

Mido, Kiyoshi. *See* Chun, Robert Y. D. 0574

Miller, Robert C. *See* Moore, Samuel L. 0471

0491 **Mina Uhink, Federico.** Desarrollo petrolero en Mexico durante 1963: Asoc. Mexicana Geólogos Petroleros Bol., v. 16, nos. 3–4, p. 45–56, illus., tables, 1964.

During 1963, 554 wells were drilled (445 development and 99 exploration). Of the exploration wells, 53 were in search of new fields. Eight new oil and gas fields were discovered: five by seismology, one by surficial geology, two by subsurface geology and seismology. Gravity and magnetic exploration also was carried out. Marine drilling of the extension of Faja de Oro under the continental shelf penetrated the middle Cretaceous El Abra reef limestone and produced oil. Total 1963 oil production was 125,829,456 bbl; gas production was 401,515,284 mcf. Proved reserves of oil and equivalent of gas, as of January 1, 1964, was 5,149 million bbl.—V.M.J.

Miró, M. *See* Lowman, F. G. 0692

Mixa, E. *See* Burnett, O. W. 0877

Moe, Eugene E. *See* Krivoy, Harold L. 0866

Molenaar, Dee. *See* Garling, M. E. 0856

0513 **Moore, Henry John, 2d.** Transportation of heavy-metal sulfides as particulate matter [abs.]: Dissert. Abs., v. 26, no. 1, p. 315, 1965.

0471 **Moore, Samuel L.; Miller, Robert C.** Geology of the Temple Hill quadrangle, Barren County, Kentucky: U.S. Geol. Survey Geol. Quad. Map GQ-402, scale 1:24,000, section, text, 1965.

Minor amounts of oil and gas have been obtained from limestone beds beneath the Chattanooga Shale (Late Devonian), but no wells are now active. Limestones in the Temple Hills quadrangle are unsuitable for commerical use due to a high content of shale, silt, and chert.—M.C.

Moore, Walter L. *See* Masch, Frank D. 0653

0495 **Mooser, Federico.** Provincias geotérmicas de México [with English abstract]: Asoc. Mexicana Geólogos Petroleros Bol., v. 16, nos. 7–8, p. 153–161, illus., 1964.

Eight geothermal provinces are defined in Mexico, on the basis of tectonic fracturing, volcanism, and distribution of thermal springs. A hypothetical connection is established between four of these provinces, relating them to a rising convection current in the Earth's mantle that extends along the Gulf of California and southeastward across southern Mexico. A related descending convection current extends along the Pacific coast of southern Mexico and is at present producing the Acapulco trench.—V.M.J.

Mooser, Federico. *See* Alonso Espinosa, Héctor. 0659

0488 **Morgan, J. H.** Availability of ground water in the Hickory quadrangle, Jackson Purchase region, Kentucky: U.S. Geol. Survey Hydrol. Inv. Atlas HA-163, scale 1:24,000, section, text, 1965.

The most important aquifer in the Hickory quadrangle is Eocene sand, containing an enormous volume of water; the depth to the main zone of saturation ranges from a few feet to 120 feet, and the saturated zone extends downward to the underlying Porters Creek Clay as deep as 550 feet; the chemical quality of the water is considered excellent. Less important aquifers include small bodies of perched water and confined water in the deeper Cretaceous McNairy Formation.—M.C.M.

0571 **Moulder, E. A.; Jenkins, C. T.** Methods for controlling the ground-water regime exploitation and conservation [with French abstract]: Internat. Assoc. Sci. Hydrology Pub. 64, p. 329–342, illus., 1964.

Analysis of part of the natural water system in the Arkansas River valley in Colorado shows that a substantial amount of water can be conserved and water used more effectively by controlled operation of the included ground-water reservoir. Resources can be increased here by storing, in the ground-water reservoir, the 6,000–9,000 acre-feet of water available from reducing the consumptive use by phreatophytes as well as all or part of the 15,000 acre-feet now being evaporated from the offstream reservoirs, both of which could be done without serious deterioration of the quality of the water in the river.—M.C.

0717 **Mueller, Robert F.** System Fe–MgO–SiO_2–O_2 with applications to terrestrial rocks and meteorites: Geochim. et Cosmochim. Acta, v. 29, no. 8, p. 967–976, illus., table, 1965.

Stability relations between solids and oxygen gas have been calculated for parts of the system Fe–MgO–SiO_2–O_2 using thermochemical data. In the field where metallic iron exists with olivine and pyroxene, the $Mg/(Mg+Fe^{2+})$ fraction in the silicates increases with decreasing oxygen pressure; in the field where ferrite coexists with olivine and pyroxene the reverse is true. The equilibria in the metallic iron field are directly applicable to meteorites and some terrestrial rocks, those in the ferrite field apply to mafic and ultramafic rocks with modifications. The oxygen fugacities thus determined may be used to calculate the "atmosphere of crystallization" consisting of other gases.—D.B.V.

0712 **Muller, J. E.; Carson, D. J. T.; Gunning, H. C.; Jeffery, W. G.** Geology, Comox Lake area, British Columbia: Canada Geol. Survey Prelim. Ser. Map 2-1965, scale 1:126,720, text, 1965.

The oldest rocks in the Comox Lake area are the Sicker Group (Permian and earlier), overlain by the Vancouver Group (Triassic and Jurrasic?). Only the lower part of the Nanaimo Group (Cretaceous) is exposed in the map-area, and the Trent River Formation is mainly covered by coastal lowland Pleistocene deposits. The structure of the area is governed by block faulting and tilting; folding is only apparent locally along some fault zones. Mineral deposits present in the area include gold, silver, copper, lead and zinc, and magnetite. Coal of high volatile A bituminous rank has been mined from some seams.—M.C.M.

Multer, H. Gray. *See* Hoffmeister, J. Edward. 0889

0526 **Murata, K. J.; Ault, W. U.; White, D. E.** Halogen acids in fumarolic gases of Kilauea volcano [abs.]: Bull. Volcanol., v. 27, p. 367–368, 1964.

0593 **Murray, F. N.; Chronic, John.** Pennsylvanian conodonts and other fossils from insoluble residues of the Minturn Formation (Desmoinesian), Colorado: Jour. Paleontology, v. 39, no. 4, p. 594–610, illus., 1965.

A thin bed in the Minturn has 30 species in 13 genera of conodonts, many fish plates and teeth, and small Foraminifera. Comparison with midcontinent forms suggests middle or late Desmoinesian age for the fauna. Ten new species are described: *Diplododella plana, Hibbardella acuta, H. obtusa, Hindeodella multidenticulata, H. megadenticulata, Idiognathus meekerensis, Lonchodina megacuspata, L. singularis, Metalonchodina fragilis* and *Spathognathodus coloradoensis*.—R.E.G.

0590 **Nassichuk, W. W.; Furnish, W. M.** *Christioceras*, a new Pennsylvanian ammonoid from the Canadian Arctic: Jour. Paleontology, v. 39, no. 4, p. 724–728, illus., table, 1965.

Christioceras trifurcatum n. sp. is one of about 15 species of ammonoids recovered from Lower or basal Middle Pennsylvanian moundlike carbonate reefs at Hare Fiord, Ellesmere Island, Northwest Territories. *Christioceras* n. gen. is assigned to the family Schistoceratidae Schmidt, Christioceratinae n. subfam. The new genus is considered to be an end member in a branch of the rapidly evolving schistoceratid stock.—J.F.M.

0874 **Naughton, John J.; Barnes, I. Lynus.** Geochemical studies of Hawaiian rocks related to the study of the upper mantle: Pacific Sci., v. 19, no. 3, p. 287–290, tables, 1965.

Eclogites and tholeiitic basalts of the Hawaiian Island chain are both good guides to composition of the upper mantle. Dating by K-Ar method on Waianae volcanics of Oahu gave ages in million years of 5.4 for the lowest member, 3.46 as the average for six trachytes, and 2.8 for the upper member, and 2.2 for a dike rock from Koolau, Oahu. For younger rocks, ages in million years were 0.4 for Puuwaawaa trachyte, Hawaii, and for Laupahoehoe from Mauna Kea, Hawaii, 0.6 for whole rock and 2.8 for mica in whole rock. Trace-element analyses on tholeiitic and alkalic suites of Waianae lavas proved Zr to be a distinctive trace element between suites. Composition of primary magmatic gas includes water, H_2, CO_2, CO, H_2S, SO_2, and S_2, and gases have an equilibrium temperature of 1200–1500°K.—M.C.

Navarro Galindo, Arsenio. *See* Díaz G., Teodoro. 0493

0599 **Neal, James T.** Airphoto characteristics of playas, [Chap.] 6 *in* Geology, mineralogy, and hydrology of U.S. playas: U.S. Air Force Cambridge Research Labs., Environmental Research Paper 96 (AFCRL-65-266), p. 149–176, illus., 1965.

Playas in the western United States have been studied on aerial photographs, and many of them have been examined in the field. Major types of playa surfaces frequently can be recognized on the basis of albedo, or amount of light reflection. Geomorphic features that can be observed include sheet wash stains, giant contraction polygons, giant contraction stripes, salt pressure polygons, phreatophytes, hot and cold springs, and surface drainage form. Recognition and understanding of the environmental occurrence of these features enable the

prediction of surface properties and the ground-water characteristics of the basins.—Author's abstract

0715 **Nelson, J. G.** Some effects of glaciation on the Susquehanna River valley: Assoc. Am. Geographers Annals, v. 55, no. 3, p. 404–448, illus., 1965.

Results of particle analysis in the Susquehanna River channel are briefly discussed and interpreted in terms of glacial effects. Results of mapping of the floodplain and the glacial deposits are presented and interpreted from the standpoint of glacial history. New information and new interpretations are presented on flooding and its effects, the extent of glaciation, the effects of Olean glaciation in the West Branch, the size of the glacial Susquehanna River, and on deglacial processes. It is possible that the glacial Susquehanna River may not have been appreciably larger than the present stream.—Author's abstract

0918 **Nettleton, L. L.** Surface ship gravity meter operations off Pacific coast [abs.] Am. Assoc. Petroleum Geologists Bull., v. 49, no. 7, p. 1087, 1965.

Newell, Marcia F. *See* Doe, Bruce R. 0681

0893 **Newman, Karl R.** Mancos to Wasatch measured section in Meeker-Rio Blanco area, northwestern Colorado: Mtn. Geologist, v. 2, no. 3, p. 135–139, illus., 1965.

Formations included in the measured section are uppermost Mancos Shale, Iles Formation, and Williams Fork Formation of Late Cretaceous age, Ohio Creek Formation and unnamed lower member of the Wasatch Formation of Paleocene age, and the basal unnamed upper member of the Wasatch Formation of Eocene age. Foraminifera were found in the Mancos, Iles, and Williams Fork Formations and their occurrence precisely defines the marine and brackish lithofacies in the section.—M.C.

0987 **Newton, Mark S.; Kennedy, George C.** An experimental study of the P-V-T-S relations of seawater: Jour. Marine Research, v. 23, no. 2, p. 88–103, illus., tables, 1965.

The compressibility of sea water has been determined as a function of salinity, pressure, and temperature. Specific volumes have been computed at salinities of zero (distilled water), 30.52, 34.99, and 41.03 ppt, pressures from 1 to 1,300 bars, and temperatures from 0°C to 25°C. Decrements of volume were measured at 100-bar intervals spaced in 5° isotherms, using a piston-and-cylinder volumometer, supplemented by a pycnometer to determine the one-atmosphere specific volumes; precision was 7 parts in 10^5. The compressibilities of the sea water indicate a systematic density difference of up to 5 parts in 10^4 at the highest pressures between the authors' measurements and currently accepted values, the former values trending lower.—V.M.J.

Newton, R. R. *See* Guier, W. H. 0540

Newton, Vernon C., Jr. *See* Deacon, Robert J. 0932

0635 **Niazi, Mansour; Anderson, Don L.** Upper mantle structure of western North America from apparent velocities of P waves: Jour. Geophys. Research, v. 70, no. 18, p. 4633–4640, illus., tables, 1965.

Apparent P-wave velocities across the Tonto Forest array in Arizona were determined for about 70 shallow earthquakes at $\Delta = 10°$–$30°$, mostly south of the array. Abrupt changes in slope of the P-wave traveltime curve at distances of about 17° and 24° are interpreted as two second-order discontinuities in the mantle region above 1,000 km. Assuming an average crustal structure as derived from seismic refraction measurements and the uppermost 200 km of mantle as given by Gutenberg or Jeffreys, it is calculated that these discontinuities are at about 320 and 640 km.—D.B.V.

0618 **Nicholas, G.; Brucker, Roger W.** Establishment of a quadrat system for quantitative ecological studies in Cathedral Cave, Kentucky: Natl. Speleol. Soc. Bull., v. 27, no. 3, p. 97–103, illus., table, 1965.

This cave is in Girken Limestone on Flint Ridge in Mammoth Cave National Park. In a 1960 survey a set of 12 quadrats was established for ecological study by setting pegs in the center of cave passages every 10 feet through the cave. From each peg, an interval of 3.4 feet was measured towards the rear of the cave to make up each quadrat, which formed a 3.4-ft band encompassing the ceiling, walls, and floor, had a diameter varying with width and height of the cave passage, and was separated from adjacent quadrats by 6.6-ft intervals. Observations have been made for each quadrat for a 5-year period and the resulting data will be published in a paper dealing with population density, fluctuations, and related factors.—M.C.

0726 **Nichols, M. M.** Flow and sedimentation of the Chesapeake Bay entrance [abs.]: Virginia Jour. Sci., new ser., v. 16, no. 4, p. 381–382, 1965.

0689 **Nordyke, M. D.; Williamson, M. M.** The Sedan event—Final report: California Univ., Lawrence Radiation Lab., Livermore, Rept. PNE-242F, 99 p., illus., tables, 1965.

Project Sedan, conducted in 1962, was a nuclear cratering experiment in alluvial material in Yucca Valley at the Nevada Test Site to extend knowledge of cratering effects to the 100-kt ranges and to provide data on safety problems to be met by nuclear explosions. The resulting crater had an apparent radius of 185 m or 608 feet and a depth of 98.5 m or 323 feet. Comparisons of its dimensions with other craters indicate that nuclear explosions result in craters with radii about 10–20 percent smaller than equivalent-yield chemical explosives but with depths about the same. Ground shock fell well below that predicted. Earth motions were influenced by the Yucca Fault, with motions on the same side of the fault a factor of two greater than those on opposite side.—M.C.

0968 **Norris, D. K.** Structural analysis of three extension faults in Number 4 Mine, Canmore, Alberta: Canada Geol. Survey Paper 65–16, 11 p., illus., 1965.

A mesoscopic analysis of these faults exposed in the roof of Number 4 coal seam has revealed that the fault surfaces are manifestly not planes. The acute angle between the faults and the layering varies somewhat systematically, but does not necessarily increase from the center line toward the extremities of the faults. The net slip varies erratically along their length, as in similar structures on a megascopic scale, the maximum not necessarily equidistant from the extremities of the faults. The pitch of slickenside striae on a given fault indicates significant lateral slip and normal slip on the same fault surface. A crude mathematical model confirms the need for lateral slip of the active block toward the extremities and normal slip at the center of even the simplest fault.—G.D.C.

0669 **Nota, D. J. G.; Loring, D. H.** Recent depositional conditions in the St. Lawrence River and Gulf—A reconnaissance survey: Marine Geology, v. 2, no. 3, p. 198–235, illus., tables, 1964.

This study is mainly concerned with the relationship between submarine topography, surface sediments, sediment sources, and present processes of deposition. Bathymetry of the basin reveals that Pleistocene glaciation determined the present shape of the St. Lawrence submarine trough; its location is tectonically controlled. Nearshore the sediments are poorly sorted coarse-grained deposits, and in the deeper parts is an extensive area of soft pelites. Between Quebec City and the mouth of the Saguenay River are stiff heavy pelites, not recent but residual. The mineralogy indicates that crystallines of the Canadian Shield are the principal sources for the sands; their chemistry emphasizes lack of intensive decomposition.—G.D.C.

0612 **Obert, L.; Stephenson, D. E.** Stress conditions under which core discing occurs: Soc. Mining Engineers Trans., v. 232, no. 3, p. 227–235, illus., tables, 1965.

Strength tests were made on specimens of Indiana limestone, Nova Scotia sandstone, Vermont marble, Maryland marble, Georgia granite, and South Dakota chalk. All,

except the chalk, formed discs, which usually were thinner when produced under higher stress values. The chalk did not disc under any combination of stresses and under higher ones tended to disintegrate. The constant k_1 (the applied radial stress axis intercept, psi) increases linearly with shear strength in all specimens indicating that discing is initiated by or is the result of shear stress. Thus, discing found in cores from deep holes probably indicates that horizontal compressive strength exceeds vertical so that the core region is subject to tectonic forces; also, horizontal stress must be higher than unconfined compressive strength.—M.C.

0917 **Obradovich, John D.** Age of marine Pleistocene of California [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 49, no. 7, p. 1087, 1965.

Ogilvie, R. E. *See* Goldstein, J. I. 0718

Okamura, R. T. *See* Kinoshita, W. T. 0870

Oliver de Padovani, I. *See* Lowman, F. G. 0692

0900 **Oliver, T. A.; Cowper, N. W.** Depositional environments of Ireton Formation, central Alberta: Am. Assoc. Petroleum Geologists Bull., v. 49, no. 9, p. 1410–1425, illus., 1965.

Shales of the Ireton Formation, Devonian, occupy the basinal areas between the Leduc reefs in the Woodbend Group of central Alberta. Marker beds, probably approximate time lines, allow subdivision of formation into rocks typical of unda, clino, and fondo environments.—E.E.G.

0964 **Orville, P. M.; Greenwood, H. J.** Determination of ΔH of reaction from experimental pressure–temperature curves: Am. Jour. Sci., v. 263, no. 8, p. 678–683, illus., 1965.

The plotting of experimentally determined crystal–gas equilibria in terms of $\log_{10}$ fugacity and reciprocal temperature can give the ΔH of reaction only if a correction is made for the effect of pressure on the solid phases. At pressures of more than two or three kilobars this correction is large and may change the value of the derived heat of reaction by a factor of two or more.—Authors' abstract

0561 **Osterwald, F. W.; Dunrud, C. R.** Geology applied to the study of coal mine bumps at Sunnyside, Utah: Soc. Mining Engineers Trans., v. 232, no. 2, p. 168–174, illus., 1965.

Study of the geologic factors related to coal mine bumps in east-central Utah indicates a spatial and genetic relationship to structural and stratigraphic features. In the Black Hawk Formation of Cretaceous age, the main coal bed is underlain by a siltstone and sandstone layer about 100 feet thick, while above the coal are channel sandstones and siltstones, both of which contain abundant slump and other sedimentary features and are interbedded with shale, carbonaceous siltstone, coal beds and black limestone lenses. These overlying beds strongly influence the incidence of bumps and the deformation of mine workings. Where stress accumulates along faults, bumps may result within 1,000 feet of the faults, for underground and surface movement takes place along the faults during bumps.—M.C.

Osterwald, F. W. *See* Dunrud, C. R. 0562

0662 **Outcalt, Samuel I.** The regimen of the Andrews Glacier in Rocky Mountain National Park, Colorado, 1957–1963: Water Resources Research, v. 1, no. 2, p. 277–282, illus., tables, 1965.

The Andrews Glacier is the only Front Range Glacier for which quantitative glacier net budget data are currently available. The National Park Service has run a transit-stadia profile down the center of the glacier intermittently, late in the ablation season, since 1957. Ablation measurements were carried out during the summer of 1962. The Glacio-Climatic Mapping Project prepared photogrammetric maps of the glacier surface from late September photography flown in 1962 and 1963. The

variation of mean summer temperature and winter precipitation at two nearby weather stations can be related to mean-height variation along the profile through regression analysis. The glacier, when viewed over the entire observation period, appears to be maintaining a near equilibrium condition. The study indicates the feasibility of applying the techniques of regression analysis to longer data series in the future.—Author's abstract

0967 **Packard, E. L.; Jones, D. L.** Cretaceous pelecypods of the genus *Pinna* from the west coast of North America: Jour. Paleontology, v. 39, no. 5, p. 910–915, illus., 1965.

Six species of *Pinna* are known from Cretaceous deposits of the Pacific Coast region of North America. These include: *P. calamitoides* Shumard, *P. brewerii* Gabb, *P. pontica* Anderson, *P. equivillana* Anderson, *P. kotsinensis* Packard and Jones, n. sp., and *P. alaskana* Packard and Jones, n. sp.—Authors' abstract

Papadopulos, I. S. *See* Bredehoeft, J. D. 0580

Paredes, E. *See* Anda, L. F. de. 0496

0916 **Parker, Frank S.** Summary geology of offshore oil producing and potential areas of Pacific Coast [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 49, no. 7, p. 1087–1088, 1965.

Petersen, Ole Valdemar. *See* Bondesen, Erling. 0697

0915 **Peterson, Gary L.** Inter- and intra-sequence faunal distribution patterns in the Sacramento Valley Cretaceous [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 49, no. 7, p. 1088, 1965.

0846 **Peterson, N. V.** Hole-in-the-Ground—Fort Rock—Devils Garden area field trip—Geologic summary, *in* State of Oregon lunar geological field conf., 1965, Guidebook: Oregon Dept. Geology and Mineral Industries Bull. 57, p. 19–28, illus., geol. maps, 1965.

These volcanic landforms are about 50 mi southeast of Bend, Oreg. Hole-in-the-Ground is a broad, shallow crater, called a maar, formed where emerging magma encountered large amounts of lake water which burst into steam; the explosions of comminuted rock fell back as laminated tuffs and breccias on the rim. Fort Rock is the remnant of such a rim, with wave-cut cliffs standing above the ancient lake bed. The largest feature is Devils Garden, where thin flows of Recent pahoehoe lava spread quietly over 45 sq mi to the south and west of fissure vents marked by spatter cones. Telltale ashy soil and pumice fragments indicate a date of flow prior to the eruptions of Mt. Mazama some 6,600 years ago.—G.D.C.

0687 **Peyronnin, Chester A., Jr.** Sediment problems of river developments in deltaic regimes, *in* Federal Inter-Agency Sedimentation Conf., Jackson, Miss., 1963, Proc., Symposium 3—Sedimentation in estuaries, harbors, and coastal areas: U.S. Dept. Agriculture Misc. Pub. 970, p. 730–738, illus., 1965.

In river systems there are many problems involving sedimentation from various sources. These are increased by river developments, and generally the more extensive the development, the more complex the problems. They are compounded when the river is actively building a delta system, as illustrated by typical examples in the lower Mississippi River valley. This paper discusses each type, and gives some of the engineering considerations in the solution of each type of problem. Migration and delta building are illustrated by the Cubits Gap delta, and delta destruction by Isle Derniere and the Timbalier Islands.—G.D.C.

0878 **Philipp, L. D.; Sheen, E. M.** Aerial and ground gamma survey monitors: Battelle-Northwest, Pacific Northwest Lab., Richland, Wash., Rept. BNWL-62, 15 p., illus., 1965.

To provide for routine aerial and ground-level environmental radiation surveys conducted routinely at Hanford, two special-purpose gamma monitors were

developed and placed in service; one, an aerial monitor for an aeroplane operated approximately 500 feet above the ground at 140 mph and the other, an instrument for a ground vehicle operated over relatively difficult terrain. Both feature scintillation detectors, solid state circuitry, portability, rugged construction, and the capability for recording data. The aerial monitor probe is a NaI(Tl) crystal and can also be used for gamma spectrometry. The ground probe is an NE-102 plastic scintillator. Either instrument can be used with other scintillators by changing the gain of the amplifier system and possibly modifying the design of the probe.—M.C.

0731 **Philippi, G. T.** On the depth, time and mechanism of petroleum generation: Geochim. et Cosmochim. Acta, v. 29, no. 9, p. 1021–1049, illus., tables, 1965.

In the Los Angeles and Ventura basins most of the petroleum is generated at depths where the shales are sterile, indicating that petroleum is formed from sediment organic matter essentially by thermal, nonbiological processes that are therefore strongly temperature-dependent. The importance of the thermal history of potential source rocks is discussed. Evidence is presented that vertical migration of petroleum, common in both basins, takes place through faults and fractures, not through the bulk of the shales.—D.B.V.

0642 **Pickering, R. J.** Use of the Swedish Foil Sampler for taking undisturbed cores of river bottom sediments, *in* Federal Inter-Agency Sedimentation Conf., Jackson, Miss., 1963, Proc., Symposium 2—Sediment in streams: U.S. Dept. Agriculture Misc. Pub. 970, p. 586–589, illus., 1965.

In the study of distribution and behavior of radionuclides released by the Oak Ridge National Laboratory into the Clinch River, undisturbed core samples were required for phases pertaining to vertical distribution of fission products in sediments. The use of simple tube-type samplers was unsatisfactory except in pure sand or leaf-matted mud. Particle-size distribution of the radioactive Clinch River sediments is about 15 to 20 percent clay, 25 to 30 percent sand, and 50 to 60 percent silt. The Foil Sampler is a piston-type in which thin metal strips are used to decrease friction between core and the sample tube. The tool and the method of its use are described.—G.D.C.

0514 **Pipkin, Bernard Wallace.** Clay mineralogy of the Willcox Playa and its drainage basin, Cochise County, Arizona [abs.]: Dissert. Abs., v. 26, no. 1, p. 316, 1965.

Plaster, Roger. *See* Meintzer, Robert. 0725

Popenoe, Peter. *See* Boynton, G. R. 0739

Popenoe, Peter. *See* Boynton, G. R. 0740

Popenoe, Peter. *See* Boynton, G. R. 0742

0619 **Pottratz, Steven W.** Ground water supply for the city of Ipswich, South Dakota: South Dakota Geol. Survey Spec. Rept. 32, 37 p., illus., tables, 1965.

The present water supply for the city comes from two artesian wells, 1,200 and about 1,550 feet deep, respectively, in the sandstones of the Dakota Group (Cretaceous) with a combined flow of about 50 gpm. While the city has a storage capacity of 130,000 g, this plus the well capacity is still not adequate for much of the year. The well water is quite hard and has a high mineral content. Test samples from glacial outwash about 4 miles outside Ipswich indicate that the water is generally of much better quality than the present supply. For the future, it is recommended that a well be drilled completely through the Dakota Group and more tests be made on the quantity and quality of the water in the outwash.—M.C.

0914 **Poynor, William D.** Relationship of Big Pine, San Guillermo, and Ozena Faults, northwestern Ventura County, California [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 49, no. 7, p. 1088, 1965.

0648 **Price, George A., Jr.** Sediment diversions through distributary channels normal to a major river, *in* Federal Inter-Agency Sedimentation Conf., Jackson, Miss., 1963, Proc., Symposium 2—Sediment in streams: U.S. Dept. Agriculture Misc. Pub. 970, p. 185–193, illus., tables, 1965.

Old River, a natural distributary leaving the Mississippi River about 300 miles upstream, carries about 25 percent of the flow from that junction. The diverted sediment concentration is similar to that in the Mississippi River; transport capacity of Old River is greater than the sediment diverted. However, a control structure on the right bank of the Mississippi 10 miles above Old River shows approximate equilibrium between load and transport capacity. The Bonnet Carre Spillway, built on the left bank of the Mississippi to protect New Orleans from flooding, empties through Lake Pontchartrain into the Gulf of Mexico. Its transport capacity is considerably less than the sediment diverted, so deposition occurs.—G.D.C.

Pryslak, A. P. *See* Davies, J. C. 0606

0486 **Pye, E. G.; Harris, F. R.; Beillie, J.** (compilers) Ogoki Lake sheet, District of Thunder Bay: Ontario Dept. Mines Prelim. Geol. Map P.274, scale 1 in to 2 mi, 1965.

0487 **Pye, E. G.** Lac des Iles area, District of Thunder Bay: Ontario Dept. Mines Prelim. Geol. Map P.275, scale 1 in to 1/4 mi, text, 1965.

The oldest rocks in the Lac des Iles area are Archean metavolcanics and metasediments which do not form stratigraphic units; to the east they are exposed and form a northeast-trending belt several miles wide; at Lac des Iles they are present as inclusions in younger igneous rocks; and they are basic and ultrabasic members of the Lac des Iles eruptive complex, which is completely surrounded by granitic rocks. The youngest rock in the map-area is Keweenawan diabase which occurs as a flat sheet at the level of the present surface and as erosional remnants up to 200 feet thick forming irregular-shaped hills. Sulfide deposits vary greatly in size, with known horizontal dimensions up to 1,000 feet. Geophysical surveys south of Lac des Iles have not been successful in locating mineralization.—M.C.M.

0533 **Pye, E. G.; Harris, F. R.** (compilers) Mojikit Lake sheet, District of Thunder Bay: Ontario Dept. Mines Prelim. Geol. Map P.267, scale 1 in to 2 mi, 1965.

Pyle, Thomas E. *See* Bryant, William R. 0906

Quiñones, L. *See* Lowman, F. G. 0692

Ramos, E. *See* Lowman, F. G. 0692

0499 **Rao, Shankaranarayana R. N.** An experimental study of subpressure in a freezing soil system [abs.]: Dissert. Abs., v. 26, no. 1, p. 262, 1965.

0699 **Rao, V. Venkatasubba.** Earthquake stability of slopes of cohesionless soils Discussion [of paper 4128 by H. B. Seed and R. E. Goodman (1964)]: Am. Soc. Civil Engineers Proc., v. 91, paper 4457, Jour. Soil Mechanics and Found. Div., no. SM 5, pt. 1, p. 109–110, 1965.

A small error is found in Seed and Goodman's derivation of equation 17, which, with equation 18, can be easily derived using the Levitation theory developed by this writer. According to this theory, a body will experience reduced weight under dynamic loads—a state similar to weightlessness. The degree of reduction will be equal to the dynamic load. Subsequent equations are rearranged.—G.D.C.

0901 **Rapson, June E.** Petrography and derivation of Jurassic-Cretaceous clastic rocks, southern Rocky Mountains, Canada: Am. Assoc. Petroleum Geologists Bull., v. 49, no. 9, p. 1426–1452, illus., 1965.

Late Jurassic and early Cretaceous sedimentary rocks in the southern Rocky Mountain region of Canada consist of three lithologic divisions, in ascending order: the Fernie Formation, the Kootenay Formation, and the Blairmore Group. The

majority of rock types are sandstones and conglomerates composed of clastic mineral and rock fragments grouped into four general suites. These suites apparently originated from four sources: a metamorphic province, a Paleozoic sedimentary province, a Pennsylvanian–Permian volcanic province, and a lowermost Mesozoic sedimentary province.—A.E.R.

0570 **Rasmussen, William C.** Permeability and storage of heterogeneous aquifers in the United States [with French abstract]: Internat. Assoc. Sci. Hydrology Pub. 64, p. 317–325, illus., tables, 1964.

Heterogeneous aquifers are water-bearing materials which conform to no single system of water flow, with movement of the water ranging from turbulent to laminar. Most hard brittle rocks such as crystalline or glassy igneous rocks, cemented or compacted sedimentary rocks, and sheared metamorphic rocks, form heterogeneous aquifers when invaded by water, with fracturing, weathering, and partial solution as causes of heterogeneity. However, honeycomb limestones, volcanic scoria, and tubular basalt are considered homogeneous and, because of the difficulty in separating water flow in them from that in fractured igneous rocks, specific capacities of individual wells and the storage and permeability of heterogeneous aquifers show a wide range of aquifer capability. Apparent permeability of a sample of 2,200 wells for an average fractured rock with an average specific capacity of 0.74 and average coefficient of storage of .001 is 9.6 gpd per square foot.—M.C.

0515 **Rasmussen, William Charles, Sr.** Geology and hydrology of the "bays" and basins of Delaware [abs.]: Dissert. Abs., v. 26, no. 1, p. 316–317, 1965.

0913 **Rau, W. W.** Biostratigraphy of "Oligocene" strata, southern Olympic Peninsula, Washington [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 49, no. 7, p. 1089, 1965.

0859 **Ray, Clayton E.** A glyptodont from South Carolina: Charleston Mus. Leaflet 27, 12 p., illus., table, 1965.

Probably the first record of Glyptodontidae (Mammalia, Edentata) from South Carolina, a postglenoid portion of a skull was washed ashore at Edisto Beach, Charleston County, after having been eroded from a presumably Pleistocene formation. Comparison of measurements with those of a nearly complete skull of *Glyptodon fredericensis* from Knox County, Texas, shows dissimilarities in size and morphology. On geographic grounds, it is probable that the specimen will be referable to *Boreostracon floridanus* when the cranium of that form becomes known; for the present, it is recorded as a glyptodont of undetermined genus and species.—V.M.J.

Ray, Richard G. *See* Lattman, Laurence H. 0598

0516 **Rechtien, Richard Douglas.** Amplitude independent static hysteresis damping as a model for earth materials [abs.]: Dissert. Abs., v. 26, no. 1, p. 317, 1965.

0883 **Reed, E. C.; Dreezen, V. H.** Revision of the classification of the Pleistocene deposits of Nebraska: Nebraska Geol. Survey Bull. 23, 65 p., illus., 1965.

In this revision, the Nebraska Geological Survey has abandoned the use of all names implying time-stratigraphy for rock-stratigraphic units, so that now Peoria is used for Peorian and local names are assigned to the former Nebraskan, Kansan, and Illinoian tills. The stratigraphic unit names are not necessarily formation names although some may be so considered. Four major continental glaciations are recognized in the upper Mississippi Valley, each followed by a warm interglacial stage when interglacial soils developed extensively and then were eroded as sea levels lowered with ice advance. The Pearlette Volcanic Ash is a great aid in correlation of the Pleistocene deposits since it forms a persistent horizon in the Sappa Formation of Late Kansan age.—M.C.

0978 **Reedy, Robert D.** Dutch Slough gas field, Contra Costa County, California [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 49, no. 7, p. 1089, 1965.

0988 **Rees, A. I.** Preliminary measurements of the anisotropy of magnetic susceptibility of the Franciscan Formation of central California: Geol. Soc. America Bull., v. 76, no. 8, p. 975–980, illus., 1965.

Measurements of magnetic susceptibility anisotropy suggest that the directions of maxima are controlled by the horizontal at the time of deposition rather than by the later forces which produced folding. The method may be useful in paleogeographic reconstruction.—A.G.

0912 **Reese, R. J.** Recent applications of digital computers to geophysical problems [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 49, no. 7, p. 1089, 1965.

0702 **Reeves, C. C., Jr.** Chronology of west Texas pluvial lake dunes: Jour. Geology, v. 73, no. 3, p. 504–508, illus., 1965.

Pluvial lake dunes of the southern High Plains include dunes formed during the last 5,000 years, dunes formed between 5,000 and 15,000 years ago, and dunes formed more than 15,000 years ago. The young series of dunes were formed by winds blowing mainly N. 5°–35° E., and the intermediate and old series by winds blowing S. 30°–90° E.—E.T.R.

Resig, Johanna M. *See* Bandy, Orville L. 0944

0730 **Reynolds, R. C., Jr.** Geochemical behavior of boron during the metamorphism of carbonate rocks: Geochim. et Cosmochim. Acta, v. 29, no. 9, p. 1101–1114, illus., tables, 1965.

The polymorphic form and boron content of illite from variously metamorphosed carbonate rocks were studied, using the percent of 2M polymorph in the illite as an index of metamorphism. Some samples were reanalyzed for boron after destruction of illite. The results suggest that boron is redistributed with increasing metamorphism. The polymorphic transformation and dravite (magnesium tourmaline) formation are completed at greenschist facies metamorphic conditions.—D.B.V.

0721 **Reynolds, Robert C., Jr.** Boron and oceanic evolution—A reply [to discussion by Bryan Gregor, 1965]: Geochim. et Cosmochim. Acta, v. 29, no. 8, p. 1008–1009, 1965.

In reply to Gregor's criticism (previous paper) it is noted that the disagreement is based primarily on quantitative grounds. Cyclic mechanisms are considered to be of comparatively recent significance, rather than to have achieved dominance by early Archean time. Extension of the two hypotheses provides a frame of reference for ideas concerning the origin of continental masses. If juvenile boron has been added over geologic time, part is incorporated in sediments permanently added to the Earth's crust; but if boron has been continuously recycled there has been no net accumulation and the continents have remained constant in size. D.B.V.

Richardson, E. V. *See* Simons, D. B. 0647

0979 **Ritzma, Howard R.** Piceance Creek Sandstone, basal Green River Sandstone tongue, northeast Piceance Creek Basin, Colorado: Mtn. Geologist, v. 2, no. 3, p. 103–107, illus., 1965.

Sandstones in the lower Green River Formation of the Piceance Creek Basin were derived from two principal sources. An upland to the southwest was the source of the Douglas Creek Member and Douglas Creek Sandstone, a tongue of the member. An eastern highland was the source of the Anvil Points Member of the Green River, an unnamed eastern shore facies of the Green River, and a sandstone tongue of these, also known as Douglas Creek. It is proposed to restrict the Douglas Creek Sandstone to the southwest part of the basin, to name the eastern sandstone tongue the Piceance Creek Sandstone and to identify it as a tongue of the Anvil Points Member and unnamed eastern shore facies of the Green River Formation.—Author's abstract

0617 **Roberts, Wayne A.** Genetic stratigraphy of the Meteor Crater outer lip: Icarus, v. 4, no. 4, p. 431–433, 1965.

Ejecta in the outer lip of Meteor Crater has been examined for subdivision into units correlative with those observed in the Sedan crater in alluvial valley fill at the Nevada Test Site. Ejecta at Sedan are subdivided into a base surge deposit, missile ejecta, and bulk ejecta. At Meteor Crater, the debris units mapped by Shoemaker (1963) are genetically equivalent to the bulk ejecta noted in the Sedan crater lip and the Pleistocene alluvium the equivalent of the missile ejecta. No evidence of a unit equivalent to the base surge deposit has been noted at Meteor Crater. However, this deposit at Sedan is the fine fraction of ejecta winnowed in flight; it is particularly susceptible to wind erosion and for the most part was stripped from the surface at Sedan in a few days.—V.S.N.

Robinson, E. *See* Trechmann, C. T. 0705

0706 **Robinson, E.** Orogenesis in Jamaica: Geonotes, v. 6, no. 1 '(Jamaica Geol. Survey Pub. 91), p. 48–52, 1964.

Chronology of Tertiary orogenesis is discussed on the basis of Robinson's work in eastern Jamaica. There were two major periods of thrusting, the first at the end of the Cretaceous with metamorphism, the second between the upper Eocene and lower Miocene with a lower grade metamorphism. The Richmond Formation and Yellow and White Limestones were deposited without major break in a sinking trough during early and middle Eocene, with slumping (flysch facies). Widespread unconformities in the White Limestone (late Eocene), are evidence of the later period of thrusting. As the result of fundamental structural change between late Eocene and late Miocene, eastern Jamaica and the Wagwater Belt in particular graduated from a deep-sea trough to a mountain belt which contributed metamorphic detritus to upper Miocene coastal formations.—V.M.J.

0563 **Robinson, G. M.** The evaluation of water-resources development by analog techniques [with French abstract]: Internat. Assoc. Sci. Hydrology Pub. 64, p. 442–454, illus., 1964.

Use of electric and hydraulic analog models to predict effects of development of ground-water resources has led to new modeling techniques and concepts of the functioning of hydraulic systems. Electric-analog techniques have proved effective in exploring changes in hydraulic head in relation to space and time while the hydraulic type have proved equally effective in similar exploration of changes related to mass transport phenomena. Among factors to be considered in evaluating the function of a hydrologic system are trends in climatic events, predictions of possible changes imposed by man, and changes in recharge to or discharge from aquifers as development proceeds. Salvage of evapo-transpiration losses appears more significant and widespread than heretofore conceded.—M.C.

0694 **Robison, Tully M.** Occurrence and availability of ground water in Ohio County, West Virginia: West Virginia Geol. and Econ. Survey Bull. 27, 57 p., illus., tables, 1964.

The consolidated rocks exposed in Ohio County belong to the Pennsylvanian Conemaugh and Monongahela Groups and the Permian Dunkard Group; older rocks are not discussed. Sandstone and limestone formations yield water to wells and springs in generally moderate quantities, which are adequate for domestic and farm needs. Perched and semi-perched water tables are common. Saline water is present in the deeper and older formations. The unconsolidated Pleistocene outwash deposits of the Ohio River and Wheeling Creek valleys are a potential source of large industrial or municipal supply; this supply is only slightly used by industries in Wheeling, because of its high mineral content and the ready availability of Ohio River water. Well records and logs are appended.—V.M.J.

Román de Vega, V. *See* Lowman, F. G. 0692

Romey, W. D. *See* Davis, Gregory A. 0980

0614 **Rooney, L. F.** Gypsum deposits in northern Indiana: Soc. Mining Engineers Trans., v. 232, no. 3, p. 268–273, illus., tables, 1965.

The Indiana Geological Survey, in 1964, discovered gypsum beds more than 10 feet thick in rocks of Devonian age in La Porte County. Previously, gypsum beds in the area were considered too thin or too deep for exploitation but current research indicates that they may be commercial deposits. In four cores taken in a square mile area, maximum thickness of gypsum and anhydrite was 35.8 feet. Maximum thickness of gypsum in one mineable unit was 12.5 feet and its purity was 81.3 percent. Chloride content of gypsum beds is less than 0.005 percent. The depth to the La Porte County gypsum is 330–500 feet, about the same as that being mined in Martin County.—M.C.

Rose, John C. *See* Strange, William E. 0861

0862 **Rose, John C.; Belshé, John C.** Gravity and magnetic fields over the proposed Moho Hole site north of Maui: Pacific Sci., v. 19, no. 3, p. 374–380, illus., 1965.

Gravity and magnetic marine surveys were made in 1964 and the results recorded through a computer data processing system. On the resulting free-air anomaly map, the proposed Mohole site lies near the point where the anomaly changes from a positive to negative field over the Hawaiian Arch and Deep, respectively. The positive anomaly cannot be explained entirely by water-depth change but can be reconciled with decrease in depth to the Moho. Its depth of origin, 8.5 km, is somewhat greater than the seismic depth to Moho, 5.8–7.0 km, the discrepancy being explained either by errors in magnetic depth estimates or difference in depth of concentration of ferromagnetic minerals from gravity settling of heavy, early-formed minerals in an intrusion. The latter seems the most likely cause.—M.C.

0530 **Rose, William D.** Oil, gas, and structure map, Madisonville West quadrangle, Kentucky: Lexington, Kentucky Geol. Survey, ser. 10, scale 1:24,000, 1964.

0887 **Rovette, John F.** Computer applications for geologists: Canadian Petroleum, v. 6, no. 9, p. 53–54, 1965.

Well data-retrieval systems being developed by government agencies and individual companies should expedite exploration projects, interpretation and correlation of basic data to the occurrence of hydrocarbons, and analysis of data. Retrieval projects are used also for paleontological, palynological, and paleoecological information; mapping; calculations of all kinds; statistical analyses; and log evaluation.—M.C.M.

Roy, Rustum. *See* Weber, J. N. 0966

0527 **Russell, Ernest E.** Geologic map of the Pittsburg Landing quadrangle, Tennessee: Tennessee Div. Geology Geol. Map GM 13-NE, scale 1:24,000, separate text, 1964.

The accompanying text, "Mineral resources summary of the Pittsburg Landing quadrangle, Tennessee," describes the sand and gravel mined in the map area. Sand and gravel deposits are associated with a series of high-level Pliocene-Pleistocene stream terraces, divided into two stratigraphic zones. The channel deposit (lower zone) of cross-stratified to poorly bedded sand and gravel ranges in thickness from a few feet to more than 30 feet; the flood plain deposit (upper zone) of sandy silt ranges from a few feet to more than 20 feet. Reserves of sand and gravel are extremely large and pits can be located almost anywhere in the gravel area indicated on the map.—M.C.M.

0583 **Sackett, William M.** The depositional history and isotopic organic carbon composition of marine sediments: Marine Geology, v. 2, no. 3, p. 173–185, illus., tables, 1964.

The total organic carbon in cores of Recent marine sediments has a $\delta\ ^{13}C$-range from –16 to –28 per mille relative to the Chicago PDB-standard. This large range is primarily due to the variation in the relative amounts of land and marine synthesized organic carbon. Sediments from the Gulf of Mexico abyssal plain show

this extreme variability as well as nearshore shelf sediments. Evidence is presented indicating that the ^{13}C-content of the total organic carbon does not change after deposition and that the same variations as observed in the Recent should also be observed in sediments back through the upper Paleozoic age.—Author's abstract

0624 **Saint-Onge, Denis.** La géomorphologie de l'Île Ellef Ringnes, Territoires du Nord-Ouest, Canada: Canada Dept. Mines and Tech. Surveys Geog. Br. Geog. Paper 38, 46 p., illus., tables, geol. map, 1965.

In this work the aim has been to describe, explain, and map the relief forms in a polar periglacial region of deep permafrost. The hypotheses presented are not final, and contribute modifications to the works of others in the Far North. The recent accent on mass movement and polygon shapes has resulted in neglect of structural influence and fluviatile erosion. Glacial tongues of icefields, located to the south and east, occupy axes of ancient drainage systems. The Pliocene and Pleistocene paleoclimates are discussed, and the effects of isostatic uplift, as well as the character of the underlying rocks. In the northern part of Ellef Ringnes Island, postglacial deposits of the Beaufort Formation cover the older rocks and form barrier beaches along the Arctic Ocean.—G.D.C.

0894 **Sanborn, Albert F.; Goodwin, James C.** Green River Formation at Raven Ridge, Uintah County, Utah: Mtn. Geologist, v. 2, no. 3, p. 109–114, illus., 1965.

Green River exposures in the area contain a complex sequence of intertonguing beds of sandstone, shale, limestone, and marlstone, which are believed to represent deposition in an orderly sequence of environments from flood plain through lake margin and stream deltas into quiet waters offshore. The outcrop area is a remarkable model of facies changes and includes seven informal units, which are, in order of deposition, the ostracodal facies, lower sandstone facies, middle shale facies, laminated sandstone and algal pellet facies, massive sandstone facies, Parachute Creek zone, and upper green shale facies. Most of these are lithofacies so the area shows a lateral as well as a vertical sequence.—M.C.

0629 **Sandberg, Philip A.** The ostracod genus *Cyprideis* in the Americas [with Russian abstract]: Stockholm Univ. Acta, Stockholm Contr. Geology, v. 12, 178 p., illus., tables, 1964.

Cyprideis, of worldwide distribution, ranges in the Americas from Maryland and California to the Straits of Magellan and from Middle Miocene to the present. The type species, *C. torosa* (Jones), and 20 American species are described; *C. mexicana* and *C. stephensoni* are new. Three American species formerly in *Cyprideis* are transferred to *Vetustocytheridea* and *Cytheridea*. Ecology and paleoecology are discussed; distribution is probably mainly by migratory shore birds. Carapace morphology, including noding and sexual dimorphism, is treated fully. Shape of normal pore canal openings and of the upper mandibular scar, and marginal denticulations are stable characters usable in species determination. Allometric equations were computed on the instars of several species for which long larval series were available.—V.M.J.

Sanders, J. V. *See* Darragh, P. J. 0674

0911 **Sanem, Robert E.; Stoddard, Robert R.** Strati-structural traps in Stevens sands [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 49, no. 7, p. 1089, 1965.

0478 **Saskatchewan Dept. Mineral Resources.** Catalogue of maps and publications, April 1, 1965: Regina, Saskatchewan Dept. Mineral Resources, 122 p., illus., 1965.

This is the latest catalogue of maps, reports, charts, regulations, and statistical publications available from the Department's Library and Map Room in Regina. Types included in map listings are geologic, geophysical including indexes, base, disposition, township plats, oil and gas, and sedimentary geological maps with cross sections. Except for the numerical list of all Department reports, listings of the following reports are all annotated: geological, geophysical, miscellaneous, mineral resources, oil and gas reservoir and statistical, and reports of Saskatchewan Research Council, Geology Division.—M.C.

0910 **Savit, Carl; Mayuga, M. N.** Long Beach Harbor geophysical and geological case history [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 49, no. 7, p. 1089, 1965.

Sayre, W. W. *See* Hubbell, D. W. 0644

0682 **Sayre, W. W.; Hubbell, D. W.** Transport and dispersion of labeled bed material, North Loup River, Nebraska: U.S. Geol. Survey Prof. Paper 433-C, p. C1-C48, illus., tables, 1965.

Radioactive-tracer techniques were used to investigate experimentally the transport and longitudinal dispersion of bed-material sand particles. The design and conduct of experiments in which radioactive particles are used as sediment tracers are discussed. A concentration-distribution function for tracer particles is derived with the aid of probability theory and evaluated with experimental data. A method for determining bed-material discharge from observed distributions of tracer particles is presented also.—W.L.G.

Sayre, William W. *See* Hubbell, David W. 0693

0657 **Sayyah, Taha Ahmed.** Geochronological studies of the Kinsley stock, Nevada, and the Raft River Range, Utah [abs.]: Dissert. Abs., v. 26, no. 1, p. 403, 1965.

0572 **Schiff, Leonard; Dyer, Kenneth L.** Some physical and chemical considerations in artificial ground-water recharge [with French abstract]: Internat. Assoc. Sci. Hydrology Pub. 64, p. 347-358, illus., table, 1964.

Maintaining or raising ground-water levels by artificial recharge provides a water source for irrigation, industrial, and domestic use and prevention of salt-water intrusion along coastal areas. Programs are being carried out in western United States, especially in California, where ground water furnishes almost half the water used and few economical surface reservoir sites are available in areas of need. A key factor is the infiltration rate, that is, the rate at which water can enter the soil, so that facilities must be based on the physical and chemical characteristics of the soil and substrata. Areas chosen should preferably be those with little change in the salt content of the soil or the water.—M.C.

0470 **Schmertmann, John H.; Taylor, R. Spence.** Quantitative data from a patterned ground site over permafrost: U.S. Army Materiel Command Cold Regions Research and Eng. Lab. Research Rept. 96, 79 p., illus., tables, 1965.

Patterned ground studies were made at Camp Tuto in Greenland between the Moltke and Petowik glaciers, where about 60 percent of the ground is patterned; emphasis was on sorted circles with raised or depressed centers. Glacial drift from the Archean complex and Thule Formation forms the surface soil cover, which is thin and discontinuous in places and underlain by permafrost of unknown thickness. The soil materials have a common mineralogy, grain size distribution, and plasticity; their chemical nature does not affect feature formation, which depends on action of mechanical processes. A sharp rise in soil water content in form of ice occurs at the permafrost contact.—M.C.

Schuster, Robert L. *See* Chaves, Jesse R. 0622

0485 **Schwab, Karl W.** Microstructure of some Middle Ordovician conodonts: Jour. Paleontology, v. 39, no. 4, p. 590-593, illus., 1965.

Thin sections show that the supposed "fibrous" genera *Erismodus*, *Chirognathus*, and *Trichnodella* of Branson and Mehl and *Ptiloconus* Sweet actually have lamellar microstructure.—R.E.G.

Searight, Walter V. *See* Kisvarsanyi, Eva B. 0549

0976 **Secor, Donald T., Jr.** Role of fluid pressure in jointing: Am. Jour. Sci., v. 263, no. 8, p. 633-646, illus., 1965.

Geologic evidence suggests that some joints are tension fractures developed perpendicular to the least principal stress direction in rock. In this study the mechanics of natural tension fracturing is examined in light of the fluid pressure theory developed by Hubbert and Rubey (1959). The Griffith theory of failure, expressed in terms of effective stresses, is taken as the failure criterion for rocks. In addition one of the total principal stress directions is assumed to be vertical and equal to the bulk weight of the overburden to the depth considered. Calculations based on these assumptions indicate that tension fractures can develop at increasingly greater depth in the Earth as the ratio of fluid pressure to overburden weight approaches one. . . . Previously formed fractures can be opened up by fluid pressure at great depth in the Earth's crust. Such open fractures probably are important in the migration of ground water, hydrocarbons, and ore fluids.—Author's abstract

0909 **Seiden, Hy.** Asphalto field [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 49, no. 7, p. 1089–1090, 1965.

0728 **Seki, Yotaro; Kennedy, George C.** Muscovite and its melting relations in the system $KAlSi_3O_8$–H_2O: Geochim. et Cosmochim. Acta, v. 29, no. 9, p. 1077–1084, illus., tables, 1965.

At low partial pressures of water and high temperatures, orthoclase melts incongruently to leucite+liquid; at somewhat higher partial pressures of water it melts congruently to hydrous liquid, and at still higher pressure it reacts with water to form muscovite+fluid(s). Muscovite in turn reacts with the fluid and disappears at still higher temperatures. The fluids resulting from the reaction of orthoclase with high-pressure water are enriched in K and SiO_2; they may escape from a cooling granitic mass and at lower temperatures introduce substantial amounts of orthoclase, sericite, or muscovite into their host rocks.—D.B.V.

0700 **Serafim, J. Laginha; delCampo, Alejandro.** Interstitial pressures on rock foundations of dams: Am. Soc. Civil Engineers Proc., v. 91, paper 4484, Jour. Soil Mechanics and Found. Div., no. SM 5, pt. 1, p. 65–85, illus., 1965.

A general review of the hydraulic problems of percolation of water in rock formations is presented, considering in particular the jointed character of the rock masses. In the measurement of interstitial pressures the condition that causes an unsteady state of flow should be considered, and also the fact that infiltration of water is dependent upon availability of open joints. Observation of the quantities of water that filtrate in relation to water level in reservoirs, and to temperature is important. Equations are established in a preliminary attempt to define the complex problems involved in filtration of water in dam foundations and in rock stability. Specific problems of each site may be considered in detail.—G.D.C.

0518 **Sharp, Robert Victor.** Geology of the San Jacinto fault zone in the Peninsular Ranges of southern California [abs.]: Dissert. Abs., v. 26, no. 1, p. 317–318, 1965.

Sheen, E. M. *See* Philipp, L. D. 0878

0531 **Shelby, C. A.; Fisher, W. L.** Heavy minerals, *in* Rock and mineral resources of East Texas: Texas Univ. Bur. Econ. Geology Rept. Inv. 54, p. 200–204, illus., table, 1965.

Main concentrations of heavy minerals in East Texas are in sands of Tertiary formations, and range from a trace to 1 percent. Principal constituents of these concentrates are fine grained magnetite, ilmenite, leucoxene, and zircon. Tourmaline, staurolite, and kyanite occur in small quantities in 90 percent of the samples, and rutile and biotite in 70 to 80 percent. Barite and limonite occur in only a few samples but make up large parts of the suites in which they occur. The various mineral constituents are described briefly. No localities known in this area contain heavy minerals in concentration sufficient to exploit, unless they could possibly be recovered as a by-product.—G.D.C.

0898 **Shelton, John W.** Trend and genesis of lowermost sandstone unit of Eagle Sandstone at Billings, Montana: Am. Assoc. Petroleum Geologists Bull., v. 49, no. 9, p. 1385–1397, illus., 1965.

The Upper Cretaceous Eagle Sandstone in the Billings area is divided into five lithologic units. The lowermost unit is described and compared with Galveston Island, a Recent Gulf of Mexico barrier island.—A.E.R.

Shofnos, William. *See* Hicks, Steacy D. 0575

0556 **Shumskii, P. A.** Principles of structural glaciology—The petrography of fresh-water ice as a method of glaciological investigation [translated from Russian by David Kraus]: New York, Dover Publications, 497 p., illus., tables, 1964.

The purpose of the volume is to summarize contemporary knowledge on structural glaciology and to use the most valuable current concepts to create a unified theory based on the genetic classification of ice types and the zonation of ice formation processes. Of the twenty chapters in the book, five are devoted to the mineralogy and crystallography of ice, eleven to the petrology of ice including studies of congelation ice, sedimentary ice, and metamorphic ice, and four to the geography and zonation of ice.—M.C.

0647 **Simons, D. B.; Richardson, E. V.** A study of variables affecting flow characteristics and sediment transport in alluvial channels, *in* Federal Inter-Agency Sedimentation Conf., Jackson, Miss., 1963, Proc., Symposium 2—Sediment in streams: U.S. Dept. Agriculture Misc. Pub. 970, p. 193–207, illus., tables, 1965.

Experimental studies carried out by the U.S. Geological Survey at Colorado State University, in laboratory flumes with a limited collection of field data are described. The characteristics (size and gradation) of the bed materials studied, the range of mean velocity, depth, slope, temperature, bed material and fine sediment concentration, and forms of bed roughness are described, illustrated, and tabulated, compared to field observations, and related to resistance to flow and bed material discharge.—G.D.C.

0501 **Singamsetti, Surya Rao.** Diffusion of sediment in a submerged jet [abs.]: Dissert. Abs., v. 26, no. 1, p. 281, 1965.

0473 **Skinner, John W.; Wilde, Garner L.** Lower Permian (Wolfcampian) fusulinids from the Big Hatchet Mountains, southwestern New Mexico: Cushman Found. Foram. Research Contr., v. 16, pt. 3, p. 95–104, 114, illus., 1965.

New fusulinids from the Lower Permian (Wolfcampian) portion of the Horquilla Limestone in the Big Hatchet Mountains of southwestern New Mexico include *Triticites (Leptotriticites) hatchetensis*, n. subgen., n. sp.; *L. gracilitatus*, n. sp.; *Rugosochusenella zelleri*, n. gen., n. sp.; and *Biwaella americana*, n. sp. In addition, topotypes from Japan of *Biwaella omiensis* Morikawa and Isomi, the type species, are described and illustrated for purposes of comparison. *Leptotricites* occurs widely over the midcontinent region and ranges stratigraphically throughout the Wolfcampian; *Biwaella* and *Rugosochusenella* are known only from the *Pseudoschwagerina* zone. These fusulinids are considered to be important for worldwide correlations and phylogenetic interpretations.—Authors' abstract

0703 **Smedes, Harry W.; Thomas, Herman H.** Reassignment of the Lowland Creek Volcanics to Eocene age: Jour. Geology, v. 73, no. 3, p. 508–510, table, 1965.

Recent potassium-argon age determinations of 48 and 50 m.y. for biotite in rocks of the Lowland Creek Volcanics in southwestern Montana agree with previous K-Ar age of 49 m.y. for biotite of a dike rock correlated with lavas of the upper part of the volcanics. Together, these determinations establish the age of the volcanics as early Eocene rather than late Oligocene, as they had been tentatively designated.—Authors' abstract

0738 **Smith, Bernard J.** Sedimentation in the San Francisco Bay system, *in* Federal Inter-Agency Sedimentation Conf., Jackson, Miss., 1963, Proc., Symposium 3

Sedimentation in estuaries, harbors, and coastal areas: U.S. Dept. Agriculture Misc. Pub. 970, p. 675–708, illus., tables, 1965.

In this landlocked series of embayments of 430 sq mi, the annual sediment load approximates 8 million cu yd, 85.5 percent from the Sacramento–San Joaquin River system and 14.5 percent from Bay area streams. Upon entry into the Bay system the density of the bedload decreases variably for different bays; the sand content is lost and silt increased while clay content remains constant. It is concluded that tidal and wind-wave-induced turbulence erodes bottom deposits and inhibits settlement; contributions from littoral sources outside Golden Gate are discounted. Historical sedimentation evidences cyclical trends, but there have been extensive changes, particularly in the last 100 years with the diversions of drainage.—G.D.C.

0596 **Smith, J. V.; Stenstrom, R. C.** Electron-excited luminescence as a petrologic tool: Jour. Geology, v. 73, no. 4, p. 627–635, illus., 1965.

Preliminary studies of cathodo-luminescence of rock-forming minerals show that this property serves for rapid identification of some minerals and for revealing structural and compositional variations in others. Separate phases in perthites are detectable by variation in color and intensity of the luminescence. Radiation halos caused by zircon inclusions are present in quartz. Apatites show a variety of colors. Detrital and secondary quartz are distinguishable by color differences. Most carbonates show red luminescence; ferroan varieties yield reduced luminescence or none. Zoning of dolomite is shown by variation in intensity of luminescence. Residual skeletal structure in fossils is detectable by luminescence. A transitory faint blue luminescence in ovoid structures in a Precambrian chert is ascribed to organic substances. Luminescence may help to establish the validity of doubtful fossil remains.—B.F.L.

0899 **Smith, Jan G.** Fundamental transcurrent faulting in Northern Rocky Mountains: Am. Assoc. Petroleum Geologists Bull., v. 49, no. 9, p. 1398–1409, illus., 1965.

Structural patterns in western Montana and northern Idaho are interpreted as transcurrent movements. These faults were concentrated along a series of deep-seated shear zones that trend west-northwest. An estimate of 175 km of left-lateral movement in northern Idaho is suggested.—A.E.R.

0713 **Stalker, A. MacS.** Surficial geology, Bassano (Gleichen, east half), west of fourth meridian, Alberta: Canada Geol. Survey Prelim. Ser. Map 5–1965, scale 1:253,440, 1965.

0581 **Stallman, R. W.** Effects of water table conditions on water level changes near pumping wells: Water Resources Research, v. 1, no. 2, p. 295–312, illus., table, 1965.

Unconfined flow of water to wells is related to the anisotropy of the aquifer, changes in coefficient of storage with time, degree of penetration of pumping well, and position of water table. Effects of these factors on water levels have been studied by field observation, analytical equations, and electric analogs. Artesian flow equations cannot be used for analysis of tests made under water-table conditions unless steady-state conditions have been approached or reached. Time needed to reach steady flow far exceeds the duration of most pumping tests, so that if the latter are to be used for measuring the hydraulic properties of unconfined aquifers, the boundary conditions attending unconfined flow must be recognized in the analysis of test data.—M.C.

0519 **Steinhoff, Raymond Okley.** Geology of the West White Lake, South Basin Duson-Ridge, Abbeville-Perry-South Perry structures, south Louisiana [abs.]: Dissert. Abs., v. 26, no. 1, p. 318, 1965.

Stenstrom, R. C. *See* Smith, J. V. 0596

Stephenson, D. E. *See* Obert, L. 0612

Stephenson, D. E. *See* Duvall, W. I. 0613

Stephenson, David A. *See* Cartwright, Keros. 0557

0588 **Stevens, C. H.** Color retention in the brachiopod *Chonetinella jeffordsi* Stevens: Jour. Paleontology, v. 39, no. 4, p. 728–729, illus., 1965.

Two specimens from the Middle Pennsylvanian Minturn Formation in Colorado display radiating spots and concentric color bands that are interpreted to be original coloration.—R.E.G.

Stoddard, Robert R. *See* Sanem, Robert E. 0911

0710 **Stout, M. L.** Gravity folds in the Modelo Formation, western Los Angeles County, California: Geol. Soc. America Bull., v. 76, no. 8, p. 967–970, illus., 1965.

Surficial folds with amplitudes up to 18 feet have formed by rock creep on dip slopes in siltstone and diatomaceous shale. The down-slope limbs usually dip more steeply and are frequently faulted.—A.G.

0861 **Strange, William E.; Woollard, George P.; Rose, John C.** An analysis of the gravity field over the Hawaiian Islands in terms of crustal structure: Pacific Sci., v. 19, no. 3, p. 381–389, illus., table, 1965.

An attempt is made to interpret gravity data in terms of the gross structure of the Hawaiian Swell, the area from Oahu to Maui; density models were constructed to represent the volcanic centers and rift zones. From the gravity and magnetic studies it appears that the lavas building the islands came from extrusions primarily along faults oriented either east-west and associated with the Molokai fracture system or northwest-southeast and associated with the trend along which lie the Koolau dike complex and the Musician Seamounts. Volcanic pipes may have formed at intersections of the two fracture systems. Later the built-up lava accumulation caused the ridge to sink to reestablish isostatic equilibrium and formed a 4-km thickening of the crust, making depth to the Moho 15 km on the ridge and 11 km in the normal ocean basin.—M.C.

Strange, William E. *See* Malahoff, Alexander. 0863

0867 **Strange, William E.; Machesky, L. F.; Woollard, George P.** A gravity survey of the island of Oahu, Hawaii: Pacific Sci., v. 19, no. 3, p. 350–353, illus., 1965.

A new gravity survey was made of this island to bring older survey results up to date. In all, 512 gravity stations were established and nine base stations were used including six old ones and three new ones at the New International Airport Terminal, New Inter-Island Terminal, and Hawaii Institute of Geophysics. Observations were made with Worden gravimeters both on the ground and in the air. The Bouguer gravity anomaly varies from a low of about +190 mgal to a high of +310 mgal; the low is associated with the Pearl Harbor area where sediments are thick and the high with the Koolau and Waianae calderas where positive anomalies are in the 115 mgal range. The topographic effect of the island is not pronounced on the map because of the gravity effects of the two major volcanic pipes.—M.C.

0652 **Striffler, W. David.** Suspended sediment concentrations in a Michigan trout stream as related to watershed characteristics, *in* Federal Inter-Agency Sedimentation Conf., Jackson, Miss., 1963, Proc., Symposium 1—Land erosion and control: U.S. Dept. Agriculture Misc. Pub. 970, p. 144–150, illus., tables, 1965.

In northern Michigan a broad range of surface geology, soils, and land use may occur within major watersheds. The Tobacco River watershed, in the central lower peninsula, is covered by a deep mantle of glacial drift. Suspended sediment in streams that cross this area from west to east can be related to the four types of deposits generally recognized—moraine, outwash, till and glacial lake bed plains. In the Tobacco River watershed, 47 percent of the suspended sediment load comes from till and lake plains that occupy 32 percent of the area; 53 percent comes from moraine and outwash plain in the remaining 68 percent of the area. A similar

division was obtained using soil association mapping units; the sediment yield also varies with land use.—G.D.C.

0608 **Sumner, John S.** The University of Arizona's gravity program in Arizona: Am. Geophys. Union Trans., v. 46, no. 3, p. 560–563, illus., 1965.

Until recently there were only 14 recorded high-accuracy gravity bases in Arizona; 50 more have now been established. The location of the regional gravity bases set up during the past year are shown in a sketch map. Another map shows the plan of the Mt. Lemmon gravimeter calibration range near Tucson. Other recent gravity surveys in Arizona by the University of Arizona and by the U.S. Geological Survey, are outlined. An analysis of earth-tide observations in the Tucson area during establishment of the regional bases showed anomalies in behaviour compared with theoretical amplitudes and values observed at Los Angeles, Calif., and Austin, Tex.—D.B.V.

0577 **Sunn, Franklin Y. K.; Abbott, Agatin T.; Chuck, Robert T.; Wiley, Frank; Lau, L. Stephen; Cox, Doak C.** Development of ground water in Hawaii—Discussions [of paper 4144 by L. J. Watson, 1964]: Am. Soc. Civil Engineers Proc., v. 91, paper 4464, Jour. Hydraulics Div., no. HY 5, pt. 1, p. 233–242, 1965.

In these discussions, treated separately, Sunn adds that Hawaiian soils often have a water content in excess of 100 percent, rainfall is readily accepted, and that water with chlorides above 250 or 500 ppm while safe to drink is objectionable in domestic supplies. Reviewing the points of Watson's paper Abbott notes too little space devoted to high-level dike-impounded water on the windward side of Oahu. Chuck's interest is in the water rights and yields; Wiley's in irrigation, particularly for sugar cane fields; Lau, concerned with sea-water intrusion, comments also on quality and pollution control in recharge areas. Cox adds to the history and realm of applicability of the Maui type of well, steam-pumped because of small fresh lenses and the lack of artesian conditions there.—G.D.C.

Taylor, R. Spence. *See* Schmertmann, John H. 0470

Thode, H. G. *See* Hulston, J. R. 0539

Thomas, Herman H. *See* Smedes, Harry W. 0703

0908 **Thompson, Jack D.** Miocene Radiolaria of Newport Bay, California [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 49, no. 7, p. 1090, 1965.

Thompson, Noel J. *See* Furumoto, Augustine S. 0876

0907 **Thompson, Robert W.** Tidal flat sedimentation on Colorado River delta [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 49, no. 7, p. 1090, 1965.

0965 **Tobi, Alex C.** On the cause of internal optical scatter in plagioclase, and the occurrence of lamellar albite-Ala B twinning: Am. Jour. Sci., v. 263, no. 8, p. 712–718, illus., 1965.

Internal optical scatter in plagioclase is attributed mainly to composition planes not following the "ideal" crystallographic directions and is produced in Wulff net plots oriented with respect to an observed composition plane or cleavage. Most lamellar albite-Ala B twins reported in plagioclase in the 30 percent anorthite range are probably ordinary albite twins masked by optical scatter. Misinterpretation is due to coincidence of X and [100] in plagioclase of the aforementioned composition. Elimination of most scatter is achieved by construction of twinning axes.—R.W.T.

0727 **Trainer, Frank W.** Water-bearing fractures in the Lockport Dolomite, Niagara County, New York [abs.]: Virginia Jour. Sci., new ser., v. 16, no. 4, p. 382, 1965.

0705 **Trechmann, C. T.; Robinson, E.** Notes on Carbonaceous Shale near Lucea, Mosquito Cove and Port Antonio: Geonotes, v. 6, no. 1 (Jamaica Geol. Survey Pub. 91), p. 53–57, 1964.

Several contemporary unrolled fossil gastropods and pelecypods from conglomerate beds or lenses in the Carbonaceous Shale (Richmond Formation) at three localities around Lucea Harbour and Port Antonio are described briefly and tentatively identified. The conglomerate also contains pieces of rolled Cretaceous limestone and recrystallized and rolled rudist fragments, probably *Titanosarcolites*. Trechmann believes that the age of the unrolled fossils and the conglomerate is Eocene, not Cretaceous as indicated on the geologic map of Jamaica (1959). A limestone collected by Trechmann south of Port Antonio (relation to conglomerate not stated) is reported by Robinson to contain rudistid fragments and unworn Foraminifera of Campanian–Maestrichtian age.—V.M.J.

0954 **Tuman, Vladimer S.** Detection of tectonic stresses by new velocity depth relation [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 49, no. 7, p. 1090, 1965.

0881 **Tuthill, Samuel J.** The fossil molluscan fauna of Pleistocene sediments of Burleigh County, North Dakota: North Dakota Geol. Survey Bull. 42, pt. 1 (North Dakota Water Conserv. Comm. Study 3), p. 93–111, illus., table, 1965.

Pleistocene Gastropoda and Pelecypoda are represented by 30 specific and subspecific taxa of 19 genera from 23 sites, all still extant in the State except for the species, *Viviparus*. The fossils occur in various types of Pleistocene sediments including some associated with the Burnstad Drift. Gastropods are most abundant occuring as 27 taxa, of which at least two are present at each of the 23 sites, while only 3 pelecypod taxa are present. Radiocarbon ages of 9,990 and 10,100 yr B.P. are assigned to molluscan shells at two sites associated with Burnstad Drift. The figures do not date the underlying till except to indicate a minimum age.—M.C.

0741 **Uchupi, Elazar.** Map showing relation of land and submarine topography, Nova Scotia to Florida: U.S. Geol. Survey Misc. Geol. Inv. Map I-451, 3 sheets, scale 1:1,000,000, 1965.

0855 **Upton, B. G. J.** The petrology of a camptonite sill in South Greenland: Medd. om Grønland, v. 169, no. 11, 19 p., illus., tables, 1965; reprinted as Grønlands Geol. Undersøgelse Bull. 50, 1965.

A thin swarm of small camptonite dikes and sills, associated with the Gardar volcanic cycle (Precambrian), were intruded in the Narssaq–Tugtutôq area. One 3-m-thick sill exposed on Igdlukasik Island and extending across Tugtutôq has been studied in detail. In the center of the sill, fractionation has produced a water- and carbon dioxide–rich residuum; concentration of large ocelli carrying analcite, calcite, and zeolites suggests the separation of a vapor phase near the end of crystallization. The initial intrusion was probably of the regional alkali basalt magma modified by addition of water, carbon dioxide, alkalies and calcium. Kimberlitic or carbonatitic magmas, or syenite magma residuals, are possible sources for this volatile-rich increment.—V.M.J.

0714 **U.S. Library of Congress.** Bibliography on snow, ice and permafrost, with abstracts: U.S. Army Materiel Command Cold Regions Research and Eng. Lab. CRREL Rept. 12, v. 19, 287 p., 1965.

The Bibliography, prepared by the Cold Regions Bibliography Section of the Library of Congress, provides a current and comprehensive coverage of basic and applied scientific research on snow, ice, and permafrost.—G.D.C.

Valantine, Vernon E. *See* Fowler, Lloyd C. 0573

0955 **Valentine, J. W.; Mallory, Bob.** Recurrent groups of bonded species in mixed death assemblages: Jour. Geology, v. 73, no. 5, p. 683–701, illus., tables, 1965.

Data on 225 assemblages of molluscan species from the Pleistocene of California are used to identify recurrent groups. Chi-square is used as a measure of grouping. The environmental significance of the groups is evaluated using information on the living occurrences of the species. The significance of groups may vary according to their size and the frequency of occurrence of their members. Large groups composed of species that occur at intermediate frequencies tend to represent

distinctive biotopes; groups of species with high frequencies of occurrence probably do not represent single biotopes.—A.T.M.

VanAmringe, John H. *See* Kilkenny, John E. 0925

VanDenburgh, A. S. *See* Garling, M. E. 0856

0631 **Vanoni, Vito A.** Review of research activities in sedimentation, *in* Federal Inter-Agency Sedimentation Conf., Jackson, Miss., 1963, Proc.—Opening session: U.S. Dept. Agriculture Misc. Pub. 970, p. 9–13, 1965.

The most significant contribution of the 15-year period preceding 1947 was the development and verification of the theory of turbulent suspension. In the early 1950's a series of papers reporting research on alluvial streams represented a return to the approach pioneered by G. K. Gilbert (1914). While a substantial number of studies in the last decade have been devoted to interrelations between bed forms and their effect on velocity and sediment discharge, others were concerned with larger features such as channel shape, river forms; and characteristic meanders, some including the entire stream system. The availability of good apparatus and improved tehinques for making sedimentation measurements are also significant.—G.D.C.

0973 **VanSchmus, Randall.** The geochronology of the Blind River–Bruce Mines area, Ontario, Canada: Jour. Geology, v. 73, no. 5, p. 755–780, illus., tables, 1965.

Rubidium–strontium analyses of 26 whole-rock and 48 mineral samples from Precambrian rocks of southern Ontario give, in m.y.: pre-Huronian rocks, about 2,500; Huronian rocks, indeterminate; Nipissing diabase (intrudes Huronian), 2,155±80; Cutler granite (metamorphoses Huronian), 1,750±50 (Wetherill and others, 1960); Eagle granite (granite of Croker Island Complex, intrudes correlatives of Nipissing diabase), 1,475±50; olivine diabase (intrudes Cutler granite), 1,225±15. The Archean–Proterozoic boundary is limited to the interval 2,155–2,500 m.y. ago. Field work confirms a post-Huronian age for the Cutler granite; correlation of the Huronian with the Animikie is therefore allowable. Whole-rock and certain discordant mineral ages of 1,700–1,800 m.y. provide evidence for the Penokean thermal event in southern Ontario. The laboratory investigation was supplemented by geologic field work and by compilation.—B.F.L.

Vernon, James W. *See* Heintz, Louis O. 0977

Vernon, R. W. *See* Wahlberg, J. S. 0683

0529 **Voegeli, Paul T., Sr.** Ground-water resources of North Park and Middle Park, Colorado—A reconnaissance: U.S. Geol. Survey Water-Supply Paper 1809-G, p. G1–G54, illus., tables, geol. map, 1965.

The general occurrence of ground water in North and Middle Parks, where hydrologic settings are extremely varied are described. Alluvium and the Coalmont Formation constitute the best aquifers in North Park, and alluvium in Middle Park. Yields from most wells and springs are small as the parks are semiclosed ground-water basins and little ground water moves out of them. The chemical quality of ground water from the many different rock types is generally good, and the water is suitable for most uses.—W.L.G.

0962 **VonDerBorch, C. C.** Source of ions for Coorong dolomite formation: Am. Jour. Sci., v. 263, no. 8, p. 684–688, illus., tables, 1965.

A study of chemistry and hydrology of lake and ground waters indicates that windblown marine cyclic salt supplies the ions necessary for the formation of Coorong-type dolomite. Excess sodium and chloride ions are seasonally flushed out of the system to the ocean by slowly seeping groundwaters. Thus, significant interbeds or admixtures of saline evaporite minerals are typically absent from the resulting thin-bedded dolomite.—Author's abstract

0683 **Wahlberg, J. S.; Barker, J. H.; Vernon, R. W.; Dewar, R. S.** Exchange adsorption of strontium on clay minerals: U.S. Geol. Survey Bull. 1140–C, p. C1–C26, illus., table, 1965.

Results are reported from a study of the ion exchange adsorption of strontium from sodium, potassium, calcium, or magnesium solutions by montmorillonite, kaolinite, and illite. The measured exchange adsorption is in good agreement with results predicted from the mass-action equilibrium equation. The adsorption of strontium is greatest from sodium solutions and least from calcium solutions.—W.L.G.

0472 **Walker, Terry.** The interpretation of the fracture finder micro-seismogram log, *in* SPWLA Logging Symposium, 5th Ann., Midland, Tex., 1964, Trans.: Tulsa, Okla., Soc. Prof. Well Log Analysts, p. I1–I7, illus., 1964.

Efforts are made to determine conditions causing extreme variation of wave form patterns on the micro-seismogram log presentation of the acoustic signal. Since the receiver signal is the algebraic sum of all arrivals within a given period of time, the time of arrival and phasing conditions should give information on bulk coupling within the formation. Calculations are made of formation velocity effects on such patterns; the shape of reflections are in agreement with actual formation velocities. Synthetic micro-seismogram logs, created by mixing oscillator signals to agree with field patterns, show characteristic patterns which can be used to interpret field logs.—V.S.N.

Wallis, James R. *See* Anderson, Henry W. 0667

0953 **Walstrom, John E.; Campbell, Frank L.** Geology analysis of well logs [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 49, no. 7, p. 1091, 1965.

0952 **Warme, John E.** Distribution and relationships of sediments and organisms, Mugu Lagoon, California [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 49, no. 7, p. 1091, 1965.

0951 **Warne, Archer H.** Structural features of North Tejon–Wheeler Ridge area [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 49, no. 7, p. 1091–1092, 1965.

0538 **Wasson, John T.** Boron in iron meteorites: Jour. Geophys. Research, v. 70, no. 18, p. 4443–4445, tables, 1965.

A colorimetric method has been used to determine boron concentrations in iron meteorites. No boron was found in five meteorites which included members of the four Ga–Ge classes, and an upper limit of 0.04 ppm is set on the concentration. This amount is substantially less than that found by previous investigators.—Author's abstract

0637 **Watts, George M.** Sediment discharge to the coast as related to shore processes, *in* Federal Inter-Agency Sedimentation Conf., Jackson, Miss., 1963, Proc., Symposium 3—Sedimentation in estuaries, harbors, and coastal areas: U.S. Dept. Agriculture Misc. Pub. 970, p. 738–747, illus., 1965.

The supply of sediments to the shore by stream and river discharge is a very important factor in the stability of a shoreline. When this supply is altered, littoral forces try to adjust the shore zone. The development of flood control and other works in upland drainage basins reduce sediment supply to the coast, resulting in shore erosion. Ventura and northern Orange Counties, Calif., are two such coastal areas. In each case the effects on the shore zone are identified and plans for improvement are described.—G.D.C.

Weber, Ernest M. *See* Chun, Robert Y. D. 0574

0966 **Weber, J. N.; Roy, Rustum.** Complex stable ⇆metastable solid reactions illustrated with the $Mg(OH)_2 \leftrightarrows MgO$ reaction: Am. Jour. Sci., v. 263, no. 8, p. 668–677, 1965.

The curve defining temperature and pressure conditions for the coexistence of brucite, periclase, and water has been redetermined using the Herold–Planje thermocouple apparatus. The equation expressing the reaction curve from 15 to 17,000 psi is given. The existence of metastable states is responsible for the variety of P–T curves previously determined. The reaction studied is $Mg(OH)_2$ (coarsely crystalline, unstrained)$\rightleftharpoons$MgO (fine-grained and/or strained)$+H_2O$. With a water pressure of 1 atm, the heat of reaction and activation energy are 312 cal/g and 45.4 kcal/mole respectively. The activation energy, obtained from kinetic data extracted from DTA curves, increases considerably with increasing pressure, from about 50 kcal/mole at 15 psi to approximately 400 kcal/mole at 17,000 psi.—E.W.W.

0604 **Weber, Jon N.** Evolution of the oceans and the origin of fine-grained dolomites: Nature, v. 207, no. 5000, p. 930–933, illus., 1965.

In connection with the problem of the origin of fine-grained "primary" dolomites, if the interpretation of Degens and Epstein (1962) is correct, dolomite replacing freshwater calcite should have an isotopic composition similar to modern or Tertiary freshwater calcites. Associated calcite would be relatively enriched in 0-16 if equilibration took place. If such dolomites show 0-18/0-16 ratios significantly higher than modern freshwater calcites, early equilibration of calcite and dolomite might be indicated. Two such freshwater deposits have been studied (1964, 1965); preliminary results are encouraging. A number of possible models are examined, all but 4 of which can be eliminated on the basis of available data on time-trends of the oxygen isotopes.—D.B.V.

0677 **Weber, Jon N.** Oxygen isotope fractionation between coexisting calcite and dolomite in the freshwater Upper Carboniferous Freeport formation: Nature, v. 207, no. 5000, p. 972–973, 1965.

A number of occurrences of very fine-grained, dense, compact carbonate rocks of freshwater origin are being examined on the basis of a working hypothesis that the dolomite originated soon after deposition of the calcite, before consolidation and lithification, and that slow growth of authigenic dolomite permitted oxygen isotope equilibrium between the two minerals. Results of an investigation of the Paleocene–Eocene Flagstaff Formation in central Utah have already been reported (1964); results for the Freeport Formation of central Pennsylvania are presented here. Enrichment in 0-18 with respect to modern and Tertiary calcites is indicated, supporting the working hypothesis.—D.B.V.

0500 **Weeden, Harmer Allen.** Multiscale photo interpretation and mapping for highway constructors [abs.]: Dissert. Abs., v. 26, no. 1, p. 264, 1965.

0671 **Wetherill, G. W.; Bickford, M. E.** Primary and metamorphic Rb–Sr chronology in central Colorado: Jour. Geophys. Research, v. 70, no. 18, p. 4669–4686, illus., tables, 1965.

Rb–Sr analyses were made of 15 whole rock samples of Precambrian granitic to granodioritic rocks from central Colorado. The results show that considerable emplacement of granitic to granodioritic rocks occurred about 1,650 m.y. ago, followed by intrusion of pegmatites about 200 m.y. later; then about 1,350 m.y. ago there was extensive redistribution, in some cases complete equilibration, of Sr between the mineral phases of these rocks. Thus, mineral ages previously measured in Colorado may largely reflect the 1,350 m.y. event, and the primary age of the basement is 1,650 m.y. or more.—D.B.V.

0675 **Weyer, Dieter.** Über *Amplexus zaphrentiformis* White 1876 (Pterocarallia: Oberkarbon, Pennsylvanian) [with English and Russian summaries]: Geologie, v. 14, no. 4, p. 449–459, illus., 1965.

This coral species was found by White in the Echo Park area of Green River in Utah in 1876 in the Morrowan Series of Lower Pennsylvanian age. The species is redescribed on cotypes and assigned to the genus *Barytichisma* Moore and Jeffords, 1945, as *Barytichisma zaphrentiforme*. *Thecophyllum* Fomichev 1953 is included as a junior synonym in *Barytichisma*.—M.C.

White, D. E. *See* Murata, K. J. 0526

0719 **Wiik, H. B.; Mason, Brian.** Analysis of eight iron meteorites: Geochim. et Cosmochim. Acta, v. 29, no. 8, p. 1003–1005, 1965.

The Fe, Ni, and Co contents of 8 iron meteorites—Ashfork (Ariz.), Balfour Downs (Australia), Canton (Ga.), Duel Hill (N.C.), Knowles (Okla.), Norfolk (Va.), Queensland (Australia), and Ysleta (Tex.) —are tabulated, and notes are given on each.—D.B.V.

Wilde, Garner L. *See* Skinner, John W. 0473

0586 **Wilde, Garner L.** Abnormal growth conditions in fusulinids: Cushman Found. Foram. Research Contr., v. 16, pt. 3, p. 119, 121–124, 130–131, illus., 1965.

Abnormal growth features are found in many Pennsylvanian and Permian fusulinids from southwestern United States and foreign areas. They include cellular fusion of two or more individuals to form one adult, multiple proloculi, engulfment, teratogenesis, and shell repair, and are not restricted to any one genus or species or special combination of the two. Usually fusion occurs in an early development stage and may produce multiple proloculi. Engulfment may involve both young and mature individuals. Teratogenesis covers development of any misshapen individual, often is attributed to shell damage, and overlaps shell repair considerably. Recognition of these abnormalities and possible causes is important for understanding of fusulinids but even more important in preventing proposals of additional taxa based on these deformed or abnormal specimens.—M.C.

Wiley, Frank. *See* Sunn, Franklin Y. K. 0577

0565 **Willets, David B.; Gould, Mitchell L.** Ground-water—A vulnerable resource [with French abstract]: Internat. Assoc. Sci. Hydrology Pub. 64, p. 482–492, illus., 1964.

The quality of ground-water resources in California has been threatened, particularly in the southern part, by rapid population growth and spread of urbanized areas over ground-water basins. About sixty percent of the population lives in the southern forty percent of the State. While the water crop averages annually roughly 70 million acre-feet in over 250 ground-water basins, the usable ground water in storage within 200 feet of the surface is on the order of 450 million acre-feet. Both industry and man have created pollution problems in the State. The various types are illustrated and the methods being applied by California authorities for their control are outlined.—M.C.

0704 **Williams, E. G.; Guber, A. L.; Johnson, A. M.** Rotational slumping and the recognition of disconformities: Jour. Geology, v. 73, no. 3, p. 534–546, illus., 1965.

Measurement of partial sections preserved in buried slump blocks in parallel and apparently transitional beds of Carboniferous rocks in western Pennsylvania suggest that disconformities are widespread, and permit reconstruction of local relief and the stratigraphic section that existed at the time of erosion. Differences of relief on the disconformities strongly affect the texture and composition of the overlying rocks.—E.T.R.

0982 **Williams, Howel.** The geology of Crater Lake Natl. Park, Oreg., . . . Cascade Range southward to Mount Shasta [abs.], (note by editors), *in* Oregon lunar geol. field conf. 1965, Guidebook: Oregon Dept. Geology and Mineral Industries Bull. 57, p. 39–45, 48–50, illus., reprinted 1965.

Tertiary volcanic history of the Cascade Range includes late Miocene intrusion of dioritic stock, development of north-south fractures along the present crest, uplift and rapid Pliocene erosion and burial by younger basaltic flows. In Pleistocene to Recent times a north-south belt of giant andesitic volcanoes formed on the basaltic plateau. The history of one of these volcanoes, Mt. Mazama, the eccentric collapse of which formed Crater Lake, is given in detail. Since Williams' account (1942), radiocarbon dating has placed the eruption at 6,600 years ago.—G.D.C.

Williams, J. B. *See* Burke, Kevin. 0707

0892 **Williamson, D. R.** The connection between kerogens and petroleum: Mtn. Geologist, v. 2, no. 3, p. 129–134, 1965.

The name *petroleum* designates a group of heterogeneous materials which differ very appreciably. Members doubtlessly had quite different histories and probably had different origins. Most petroleums seem to be accumulations of hydrocarbons which largely existed as such when, or soon after, organic debris decomposed. These sometimes became entrapped in sediments as part of the organic material which was partially converted to kerogen.—Author's abstract

Williamson, M. M. *See* Nordyke, M. D. 0689

0733 **Wilson, Charles W., Jr.** Geologic map of the Murfreesboro quadrangle, Tennessee: Tennessee Div. Geology Geol. Map GM 315–SW, scale 1:24,000, separate text, 1964.

The text, "Mineral resources summary of the Murfreesboro quadrangle, Tennessee," describes the limestone resources of the area. The Ridley Limestone, bedrock in most of the quadrangle, is 100 to 150 feet thick and has many general uses. The Murfreesboro, restricted in outcrop to inliers along major streams where the maximum thickness is as much as 70 feet, has less potential because of limited extent, generally thin exposures, and occurrence along streams; the Lebanon, about 100 feet thick, is shaly, thin bedded, and of limited distribution, but is usable for general purposes. Only one large quarry is active.—M.C.M.

0734 **Wilson, Charles W., Jr.** Geologic map of the Dillton quadrangle, Tennessee: Tennessee Div. Geology Geol. Map GM 315–SE, scale 1:24,000, separate text, 1964.

The text, "Mineral resources summary of the Dillton quadrangle, Tennessee", describes the limestone resources of the area. The Ridley, Carters, and Lebanon Limestones are the most desirable formations for quarrying, but no quarries are active at present. The Ridley is about 100 feet thick and is suited for most purposes; the Lebanon, about 80 to 120 feet thick, is more shaly and thin bedded; the lower member of the Carters is 30 to 70 feet thick and is generally usable.—M.C.M.

0691 **Wilson, J. Tuzo.** Submarine fracture zones, aseismic ridges and the International Council of Scientific Unions Line—Proposed western margin of the East Pacific Ridge: Nature, v. 207, no. 5000, p. 907–911, illus., 1965.

It is suggested that the fracture zones represent the motion of plates in the crust relative to one another, while the pairs of aseismic ridges represent movements of these plates relative to the mantle. The consequences to be expected if a pair of aseismic ridges intersect a fracture zone are envisaged. Some specific relationships between the East Pacific Ridge, fracture zones, aseismic ridges, and magnetic anomaly patterns are predicted. The western margin of the East Pacific Ridge is traced. It is concluded that the fracture zones and aseismic ridges are associated with the East Pacific Ridge, and that the Pacific Ocean floor is moving northwards.—D.B.V.

0520 **Wodzicki, Antoni.** The distribution of some trace elements near contact aureoles in the Santa Rosa Range, Nevada [abs.]: Dissert. Abs., v. 26, no. 1, p. 318–319, 1965.

0632 **Wolman, M. Gordon.** Educational needs and opportunities in the sedimentation field, *in* Federal Inter-Agency Sedimentation Conf., Jackson, Miss., 1963, Proc.—Opening session: U.S. Dept. Agriculture Misc. Pub. 970, p. 13–17, 1965.

There are many varied approaches to sedimentation, all generally related to engineering. A sampling of the larger State university and private institution curriculums in engineering and in geology were reviewed. From the standpoint of courses and textbooks, the quantity of offerings is limited, the material offered is fragmented or for a specialized audience, and virtually no courses or texts are available that present a comprehensive view of principles and problems in

sedimentation. A larger task of education would appear to be in broadening the understanding of sediment problems among engineers and others dealing with land and water, stimulating research, and disseminating knowledge to a wider audience.—G.D.C.

Woollard, George P. *See* Furumoto, Augustine S. 0848

0849 **Woollard, George P.** Problems of the upper mantle and Hawaii as a site for the Moho Hole: Pacific Sci., v. 19, no. 3, p. 271–284, illus., table, 1965.

Major scientific advantages of drilling the Mohole north of Maui would be: mean velocity of the mantle here is normal for the Pacific Ocean; mantle material is truly anisotropic as shown by seismic measurements, so that cores should reveal minerals causing anisotropic transmission; and crustal structure shows local thinning of the crust and subnormal thickening of the basal crustal layer. The latter has a velocity higher than that of the area as a whole and should furnish data on the relation of crust–mantle boundary rocks as well as development of crustal structure, depth of the Moho, and means of maintaining isostasy. Studies being carried out on the present volcano at Kilauea, which draws material from below the mantle–crust boundary, would provide a continuing program related to the Mohole Project.—M.C.

Woollard, George P. *See* Strange, William E. 0861

Woollard, George P. *See* Kroenke, Loren W. 0864

Woollard, George P. *See* Strange, William E. 0867

Woollard, George P. *See* Manghnani, Murli H. 0875

Woollard, George P. *See* Furumoto, Augustine S. 0876

0974 **Wornardt, Walt W., Jr.** Stratigraphic and paleoecologic significance of diatoms and silicoflagellates [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 49, no. 7, p. 1092, 1965.

0576 **Yalin, M. Selim.** Geometrical properties of sand waves [reply to discussion of paper 4055, 1964]: Am. Soc. Civil Engineers Proc., v. 91, paper 4464, Jour. Hydraulics Div., no. HY 5, pt. 1, p. 184–190, illus., 1965.

The writer agrees with White and MacMahon in their discussion of his paper that considerable research is still necessary into the problem of sand waves and that his formulas represent the size of the bed features in an approximate manner only. His reply is, therefore, confined to dealing with points raised by White and MacMahon, and to clarifying his form of plotting.—G.D.C.

0960 **Yasso, Warren E.** Plan geometry of headland–bay beaches: Jour. Geology, v. 73, no. 5, p. 702–714, illus., 1965.

A "headland–bay beach" is one that lies in the lee of an isolated headland and is concave seaward. The shoreline of Spiral Beach, formed in the lee of a man-made groin on Sandy Hook, N. J., approximated the logarithmic spiral, $\ln r = \theta \cot \alpha$, with its center near the headland of the groin. Similar curvatures were found by computer analysis of mapped shorelines of Halfmoon Bay Beach and two beaches on Drakes Bay, Calif. It is suggested that the geometry of several hundred other headland–bay beaches of the Unites States' coastline be studied by means of aerial photographs, field mapping and models.—R.E.W.

0854 **Youmans, A. H.; Hopkinson, E. C.** Field results of Neutron Lifetime Logs in Gulf Coast wells: Am. Petroleum Inst. Drilling and Production Practice 1964, p. 156–163, illus., 1965.

A new nuclear logging method recently introduced into the Gulf Coast area can distinguish between oil and brine through the hole casing. It uses a pulsed accelerator-type neutron source and a scintillation counter to measure the lifetime

of thermal neutrons in formations by recording the intensity of neutron capture radiation during the interval between source pulses when neutrons in the bore hole have died away. The log, called a Neutron Lifetime Log, is based on the fact that, in ordinary rocks, thermal neutrons have a measurable lifetime which varies with variations in reservoir-fluid and rock characteristics.—M.C.

0595 **Young, Robert G.** Distribution of uranium deposits in the White Canyon Monument Valley district, Utah-Arizona: Econ. Geology, v. 59, no. 5, p. 850-873, illus., 1964.

Uranium minerals fill interstices and replace carbonaceous matter in the coarse clastic channel-fills marking the base of the Triassic Chinle Formation. A two-stage origin of the deposits is proposed. Preliminary concentration involved northward ground-water transport, in ore channels, of uranium obtained from weathering or volcanic emanations, and deposition in H_2S-rich reducing environments surrounding organic debris, not long after sediments were laid down. Much later reconcentration occurred, after upwarp and erosion, when oxidizing ground water redissolved uranium and carried it down-dip along the same channels to a new reducing environment.—W.S.W.

0905 **Young, Robert G.** Type section of Naturita Formation: Am. Assoc. Petroleum Geologists Bull., v. 49, no. 9, p. 1512-1516, illus., 1965.

The Cretaceous Naturita Formation is 121 feet thick at its type locality near Naturita, Colo. The Naturita consists of conglomeratic sandstone, carbonaceous shale and coal, and sandstone representing deposits of littoral marine, lagoonal, estuarine and paludal environments.—W.C.C.

Zandle, G. L. *See* Boynton, G. R. 0739

Zandle, G. L. *See* Boynton, G. R. 0740

Zandle, G. L. *See* Boynton, G. R. 0742

0949 **Zietz, Isidore; Geddes, Wilburt.** Crustal study of transcontinental strip east of Rocky Mountains [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 49, no. 7, p. 1092, 1965.

0716 **Zoltai, S. C.** Kenora-Rainy River, surficial geology: Ontario Dept. Lands and Forests Map S165, scale 1:506,880, text, 1965.

Ground moraine in the Kenora-Rainy River area is the most widely distributed glacial deposit, forming a discontinuous mantle on bedrock; generally it consists of sandy till with large amounts of boulders, stones and gravel and very little clay, the till being generally less than 3 feet thick, but reaching 30 feet in drumlins. End moraines consist of sand, gravel and boulders and their thickness may reach 150 feet. Glaciofluvial deposits occur as elongated esker complexes and in kames, where thickness may attain 100 feet. Glaciolacustrine deposits are mainly varved clays and vary in thickness from 2 to 30 feet. A discontinuous, thin layer of loess (less than 2 feet thick) occurs in the eastern part of the area, and organic deposits of peat and muck occupy many depressions or plains. The glacial history of the area is discussed.—M.C.M.

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